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May 1991 Vol. X No. 10

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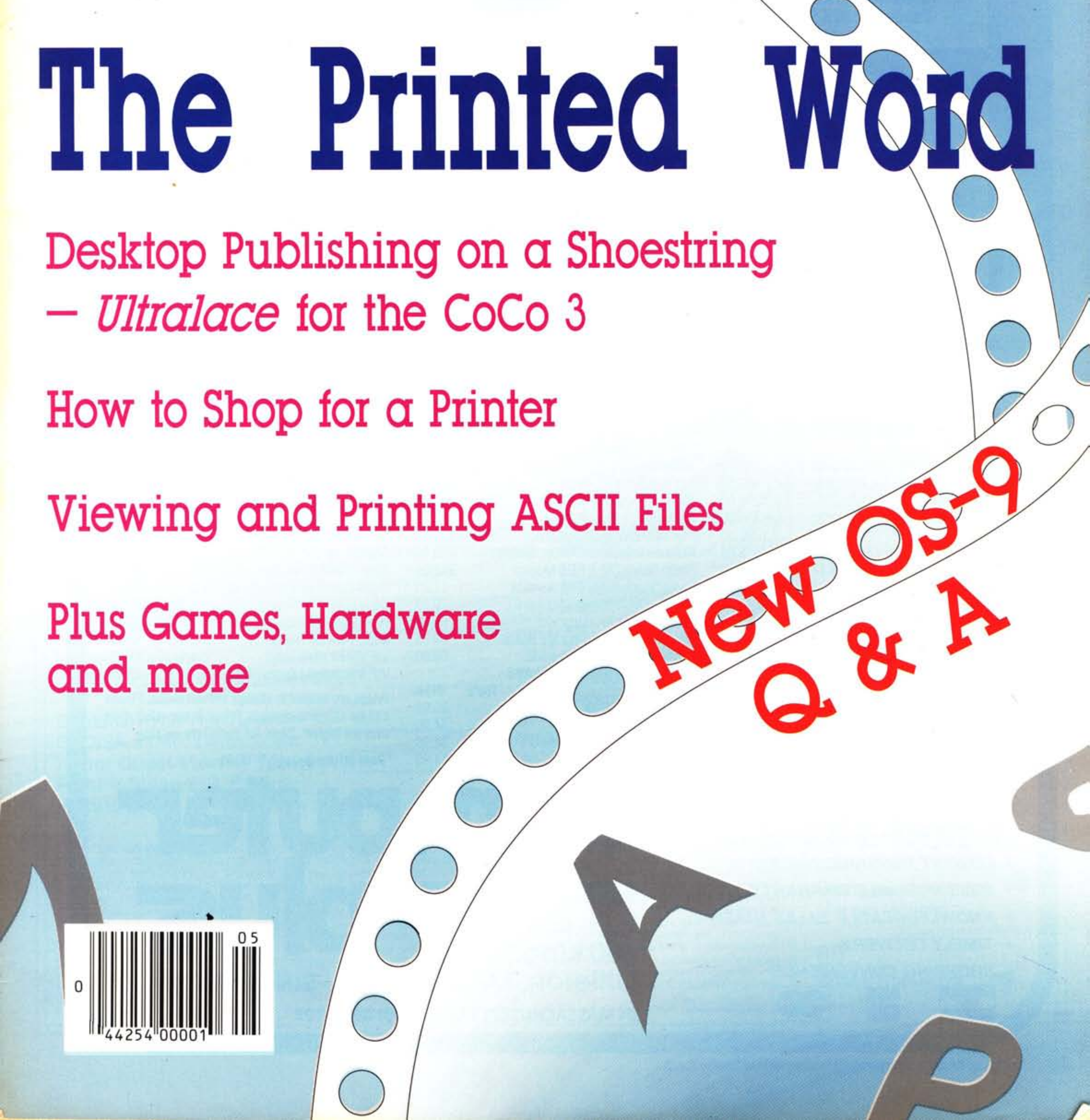

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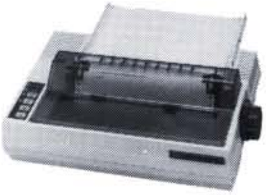

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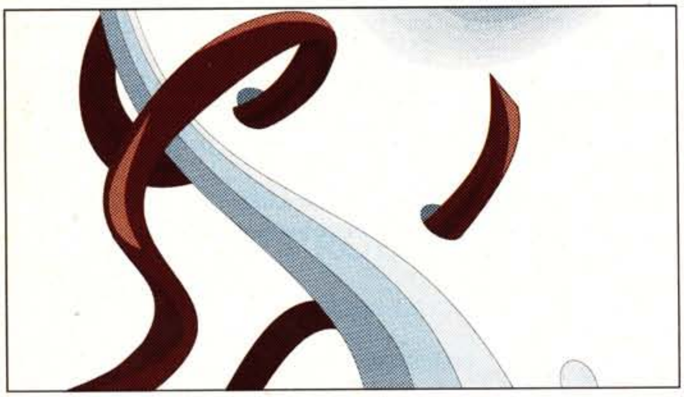

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H. Allen Curtis
The ultimate shoestring desktop publisher

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Letters to the RAINBOW

RASCAN Dilemma

Editor:

Since we started selling the RASCAN digitizer, we have been swamped with phone calls and mail from CoCo users who had ordered the unit from Game Point Software. Because of the volume of inquiries, it is becoming increasingly difficult to meet the needs of our own customers. I am writing to provide some clarity on the matter.

Supersoft independently obtained exclusive rights to produce and market RASCAN in 1990. We obtained these rights from the developers of the product. Supersoft is in no way connected with Game Point Software.

In light of this, we cannot help past customers of Game Point Software. Also, Game Point Software cannot legally produce or market the RASCAN unit. Finally, we will not replace, repair or exchange units marketed by Game Point.

This is an unfortunate situation, and I am sorry we cannot be of greater service to these people. We work to provide service to our own customers, but we have no control over what other vendors do. I do want to point out that Supersoft customers are receiving their RASCAN units.

Joe Walker
President
Supersoft, Inc.
Jackson, Michigan

Needs Help With CoCos and VCRs

Editor:

I recently purchased a CoCo 3 so I could use the audio and video outputs with my VCR. After owning a CoCo 2 for a number of years, and having a novice's understanding of BASIC, I find the CoCo 3 an amazing upgrade. Incidently, I own a part-time video company and need information on where I can find fonts for video formats to use at weddings and other events. Also, could you please explain the use of the CoCo 3 as a video editor/controller and if there is a BASIC program for this?

Dwayne Kinsey
23 Straw Bridge Avenue
New Castle, DE 19720

Downgrade Poke

Editor:

This is a note to let you know I am very pleased with THE RAINBOW and what it has taught me in the last few years. I presently have a CoCo 3, a Multi-Pak, a disk drive and a TP-10 printer. I must say that I have not seen a better magazine for information than THE RAINBOW.

I need some information and hope you can help me. I have some software I purchased when I had the CoCo 2, and I would like to use it with the CoCo 3. I've been told there is a poke to put the CoCo 3 in a CoCo 2 mode. If this is so, perhaps you can help.

Any kind of reply would be of great help. I contacted Tandy Corporation in Barrie, but I was not given any help at all.

R.N. Geroux
Box 151
Coldwater, ON L0K 1E0
Canada

While the CoCo 3 supports most aspects of the CoCo 2, there is no "CoCo 2 mode," per se. You need to contact the orginal producers in cases where specific software does not run on the CoCo 3. Another source of information and patches is Delphi. Also, remember the CM-8 doesn't support the artifact colors used heavily in CoCo 2 software; this alone doesn't qualify as a software incompatibility.

Computerized Hymnals

Editor:

I'm looking for disks containing hymns, both popular and traditional, written using *Musica II* or *Lyra*. I play the music simultaneously through two MIDI devices: A Casio MT-240 and a Yamaha PSS-480. Please send titles and prices to me.

Herb V. Fickbohm
921 Katherine St.
Vermillion, SD 57069

The Lyra Library, *available from Rulaford Research, contains a number of popular and traditional hymns. See the review in the December 1988 issue of THE RAINBOW (Page 133). If you are willing to whet your whistle with OS-9, buy a copy of* UltiMusE III *from Second City Software. There is a vast assortment of hymns available in the OS-9 SIG on Delphi, and they're entered specifically for the PSS-480.*

Talking to the Plug'n Power

Editor:

Where can I find software to use the newer Radio Shack Plug 'n Power interface with OS-9 Level II? I have not, as yet, found anything for this on Delphi. Also, does

COCO HARDWARE CATALOG

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(See Page 7 for Ordering Information)

anyone have an OS-9 COBOL compiler for under $100? Either new or used is fine.

Mike Dalene
39 Upland Road
Winsted, CT 06098

Rumor has it that at least one independent company is working on software that allows you to use the Appliance and Light Controller unit on the CoCo 3 under Disk BASIC. But we don't know of anyone doing the same for OS-9 — yet.

We don't know of any COBOL compilers currently available for the CoCo. Perhaps another reader can help.

Disk BASIC/MS-DOS Transfers

Editor:

Is there a transfer utility for transferring data from a Tandy Color Computer to a PC-compatible Pal 286 (with MS-DOS 4.01) from Laser Computers?

Rick Benton
501 Sixth Street
Charles City, IA 50616

For PC-based software, consider Xenocopy *and* CoCoUtil II *from Microcom Software, and* Elite Transfer *from Elite Software. In the June and July 1986 issues, we published a CoCo-based system designed by Marty Goodman.*

Editor:

Is there any software for the CoCo 3 that can be used to read IBM programs without having to download then with a modem?

Also, can anyone recommend a good sound digitizing program for the CoCo 3 that would allow me to change the pitch, speed and tone of recorded sounds? I appreciate any help on this matter.

James Ruth
128 Seymoure Avenue
Newark, NJ 07108

See our answer to Rick Benton, above. Do keep in mind, however, programs written to work on MS-DOS computers won't directly work on the Color Computer.

Keep on Truckin'

Editor:

This past year has been quite a year for those of us here in Kokomo. We still have 67 strong, enthusiastic members in the club. Amazingly, 34 members own 64K CoCo 2s and expect CoCo 2 programs and demonstrations to be presented at our monthly meetings.

So I have a tremendous responsibility. During a year I must have demonstrations and programs for the CoCo 1, 2 and 3 plus OS-9 Levels I and II as well as keeping the members updated on happenings with Frank Hogg's Tomcat and IMS' MM/1. I never know what to expect at a meeting because some member is sure to bring something for a demonstration, or to disclose some bit of news about the Color Computer.

Frankly, neither I nor my officers could halfway begin to do our jobs without the help THE RAINBOW provides. I find it encouraging that you cannot find someone to write the history of the CoCo as I don't believe the CoCo's history is finished. Our [Delco] engineers are now working in 32-bit stuff, so the story continues. I just wish some of them could find time in their busy schedules to write some articles for THE RAINBOW. The CPUs in the Tomcat and the MM/1 present some interesting challenges, especially in the area of graphics.

Since both *68 Micro* and *CoCo Clipboard* have folded, THE RAINBOW is the remaining major source of information about Motorola's 68xx chips. I want you to know that your efforts to persevere in continuing to publish THE RAINBOW are appreciated more than we can even begin to express on paper. I am excited about the future. The things happening with programming in C and C++, along with the multitasking, multiuser capabilities of the 32-bit chips, will enable us to have true multimedia computers at an affordable price long before the 80x86 crowd gets around to it.

I hope to see you at RAINBOWfest in Chicago. Keep on keeping on.

Donald R. Adams
General Manager
Delco Electronics
Color Computer Club
Kokomo, Indiana

Supporting Documentation

Editor:

We just finished reading your latest editorial on documentation ("Print #-2", February 1991, Page 8), and we really enjoyed it. It perfectly expressed our thoughts on the subject. As an example of what might be considered excellent documentation, we draw attention to the *Max-10/CoCo Max III* programs that even a CoCo beginner can learn and use in very short order. Our thanks also for mentioning the fact that programmers tend to write as though all of us are programmers. Hopefully, we all may one day be able to program our CoCos, but until then we're afraid we must rely on others. Our many thanks for your fine magazine. Keep up the good work.

Fred and Nancy Wilson
Waynesboro, Georgia

Misaligned Printer

Editor:

I have a DMP-105 printer and have noticed a problem: When the printer is in the bidirectional mode, every line printed with the carriage moving right to left is off by one dot column. This happens when the printer is in a character printing mode, but not in the graphics mode. It does not occur when the printer is set for unidirectional printing. How can this be corrected?

Tom Batchelder
122 Syrcle Drive
Milton, FL 32570

The problem is a result of inaccuracies in the head-positioning mechanism and is common in low-end printers. You pretty much have only two options: Stick with unidirectional printing or buy a printer with more accurate mechanics.

Hamming It Up

Editor:

I use my CoCos 90 percent of the time for ham radio. I am looking for APLINK software, on either a 5¼-inch or 3½-inch disk, to run on my 512K CoCo 3 system. Maybe someone there or one of the software suppliers could help me. I have *Autoterm* and the AEA PK232MBX.

John L. Chandler (K4VDM)
809 Lincoln Avenue
Johnson City, TN 37604-4451

Looking for Another Slot

Editor:

Well, I finally got wise and purchased a Color Computer disk drive. Information retrieval is both fast and easy with the disk drive system. I only have one problem: How do I use my disk drive system at the same time with Color File 2, the Speech/Sound Program Pak, and Orchestra-90CC? Some of the manuals for these program paks mention a device known as a Multi-Pak Interface. I went to purchase one at my local Radio Shack Store, but to my disappointment they were discontinued several years ago. Does anyone out in CoColand know where I can get one? Thank you.

Lee T. Bufkin
14145 Troester
Detroit, MI 48205

The Multi-Pak Interface has been discontinued, though you may find one at some Radio Shack locations. Another option is to check the classified ads on Delphi. Last but not least, consider the Slot Pak III from Howard Medical. A review of this multi-slot device appears in next month's issue. As a side note, because the software in the Color File 2 Pak is "hard-coded" for a tape system, you will not be able to load and save Color File 2 data with your disk drive.

Continued on Page 74

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Print#-2

My First Printer

Judging from all the mail I get, there are very few of you out there who do not have some sort of printer attached to your CoCo. And no wonder. I have always found that a printer is simply a necessary complement to my computer.

But it was not always so. In fact, next to the actual purchase of the computer itself, I would say the acquisition of a printer was the biggest single step in the enjoyment of my CoCo.

Today there are something like eight gazillion printers you can use with CoCo. But a decade ago, that wasn't the case — and certainly not in *my* budget. In fact the only printer that *was* available for less than about $500 was something called a Quick Printer II.

Also judging from my mail, many of you are "fighting" this or that problem. So it may help to know that everyone has been through this, and it is in that vein that I tell you of my early printer adventures.

My friendly Radio Shack salesman called one day to say he had a new printer that would work with my Color Computer and it was only $159.95. He also said he had only one of them. So, naturally, I rushed to the store to look at this marvel.

It was a little thing in battleship gray, just like the original CoCo. What was most interesting was that the paper it used was also gray — a metallic surface that, when struck by the pins in the printer, turned black. Hey, that was OK. I was dying to print a couple of BASIC listings and to see a "whole" biorhythm chart at once.

So I bought it, took it home, plugged it in, went through all the tests, and then read the part of the manual (which was not particularly extensive) that talked about connecting the printer to the computer.

"Hey, Jeff," I said on the phone a few moments later, "I need a cable for this printer."

> **Next to the actual purchase of the computer itself, I would say the acquisition of a printer was the biggest single step in the enjoyment of my CoCo.**

"What kind of cable?" he asked.

I searched through the pages and came up with the answer. "A serial cable."

"Uh, I'll have to try to order one."

Four days later, no cable. I ran the self-test on the printer every day just to be sure it did not die of neglect.

"You could make a cable," Jeff suggested. "We have the cable and the plugs."

This is not as outlandish as it seems. Remember, this was 10 years ago.

Back, back, back . . . to the Shack, Shack, Shack . . . for more, more, more.

"What kind of connector do you need?" Jeff asked. I showed him the printer. He asked someone else. They went looking.

"You need a 5-pin DIN plug," he said. "We only have 4-pin DIN plugs."

Well, heck. The store manager let me use his office. I called electronics supply houses. I actually found one, rushed over, and bought it.

For the first time in my life, I soldered something together. I plugged one end into the CoCo, the other into the Quick Printer II and typed `PRINT#-2, "Hi Printer!"`

It actually worked.

I quickly discovered the Quick Printer II was the "natural" choice for the CoCo because its printout was 32-characters wide, just like the CoCo screen. I even bought a little file box in which to put my printouts and learned to flatten them so they would not curl up. The Quick Printer II paper was really heavy and tended to stay rolled up, even after it had been through the printer.

But I loved it. I could get BASIC listings longer than the screen. I could do reports. I could even leave memos to the kids. It made a world of difference.

It was not until I decided to publish THE RAINBOW that I bought another printer — a Line Printer VIII that printed on regular paper and had an 80-column printout. The first three or four issues of this magazine were printed on it.

Because the Line Printer VIII did not have descenders on its letters and the magazine was getting bigger, I invested in an Epson. That printer was used for the rest of our first year, until we went to real typesetting. Actually the *major* reason for this purchase was that someone had written a word processor for the CoCo by that time, and the only printer it supported was an Epson.

I think the moment the Quick Printer II spit out Hi Printer! was one of my greatest moments in computing. As the world goes, it didn't rank up there with Samuel Morse's "What hath God wrought?" or Alexander Graham Bell's "Mr. Watson, come here, I want you." But, for me, it did.

— Lonnie Falk

Novices Niche

File Utility　OS-9 Level II

OS-9 File Viewer

by James Ross

Scroll File allows you to use the up and down arrow keys to scroll forward and backward through ASCII text files. The program requires that the file to be viewed be in ASCII format, and each line must be terminated with a carriage return ($0D). Also, each line should contain no more than 255 characters. However, only the first 79 characters of each line are shown on the screen. Finally, the program should be run in an 80-column by 24-line window.

Enter the program in BASIC09's workspace and save the source code as `scrolf.b09`. Then use the `pack` command to save an executable copy to your current execution directory as `scrolf`.

To use `scrolf`, make sure runb is in memory or in your current execution directory. Switch to an 80-by-24 window and enter

```
scrolf ("filename")
```

where *filename* is the name of the file to be viewed. If you are using *Shell+*, the parentheses and quotations are not necessary. Use the down arrow to scroll down (toward the end of the file) and the up arrow to scroll up (toward the beginning of the file). To exit, press ESC (CTRL-BREAK), CTRL-C (SHIFT BREAK) or CTRL-E (BREAK).

You can use the following commands to create an 80-by-24 window (Window 3) and start a shell in it:

```
iniz w3
wcreate /w3 -s=2 0 0 80 24 0 2 2
shell i=/w3 &
```

If you are already using Window 3, substitute an unused window number for w3 in the above commands.

The Listing: `scrolf.b09`

```
PROCEDURE scrolf
 0000      DIM filepath,key:BYTE
 000B      DIM count,top,bottom,last:INTEGER
 001E      DIM sk:REAL
 0025      DIM line$:STRING[79]
 0031      DIM inline$:STRING[256]
 003D      DIM skptrs(1564):REAL
 0049
 004A      PARAM filename$:STRING[32]
 0056      OPEN #filepath,filename$:READ
 0062
 0063      SHELL "tmode -echo"
 0072      PRINT CHR$(5); CHR$($20); CHR$($0C)
 0081
 0082      ON ERROR GOTO 12
 0088
 0089      count=1 \sk=0
 0098      WHILE EOF(#filepath)=FALSE DO
 00A4        skptrs(count)=sk
 00B0        READ #filepath,inline$
 00BA        sk=sk+LEN(inline$)+1
 00CC        count=count+1
 00D7      ENDWHILE
 00DB
 00DC      last=count \count=1
 00EB      WHILE count<>25 AND count<>last DO
 00FF        SEEK #filepath,skptrs(count)
 010C        READ #filepath,line$
 0116        IF count<>24 THEN PRINT line$
 0126        ELSE PRINT line$;
 012F        ENDIF
 0131        count=count+1
 013C      ENDWHILE
 0140
 0141      top=1 \bottom=count-1
 0153      LOOP
 0155        GET #0,key
 015E
 015F      EXITIF key=$71 THEN ENDEXIT
 016F
 0170        IF key=$0C THEN
 017D          IF top=1 THEN 9
 018C          top=top-1 \bottom=bottom-1
 01A2          PRINT CHR$(1); CHR$($1F); CHR$($30);
 01B2          SEEK #filepath,skptrs(top)
 01BF          READ #filepath,line$
 01C9          PRINT line$;
 01CF          GOTO 10
 01D3        ENDIF
 01D5
 01D6        IF key=$0A THEN
 01E3          IF bottom=last-1 THEN 9
 01F6          top=top+1 \bottom=bottom+1
 020C          PRINT CHR$(1); CHR$($1F); CHR$($31);
 021C          PRINT CHR$(2); CHR$($20); CHR$($37);
 022C          SEEK #filepath,skptrs(bottom)
 0239          READ #filepath,line$
 0243          PRINT line$;
 0249          GOTO 10
 024D        ENDIF
 024F
 0250 9      PRINT CHR$($07);
 025A 10   ENDLOOP
 0261
 0262 12   CLOSE #filepath
 026B      PRINT CHR$($0C); CHR$(5); CHR$($21);
 027B      SHELL "tmode echo"
 0289      END
```

Ultralace the First Loop

The ultimate shoestring desktop publisher

by H. Allen Curtis

When my shoestring desktop publisher first appeared in THE RAINBOW (October, 1987) there were no others readily available to CoCo users. My desktop publisher was written to appeal to the individual who wanted to produce attractive letters, newsletters, greeting cards, pamphlets, schedules, advertisements, etc. The shoestring desktop publisher has evolved from a program with minimal facilities to a nearly full-featured desktop publisher.

H. Allen Curtis lives in Williamsburg, Virginia. He is interested in 17th and 18th century history and enjoys biking through the colonial capital. He balances past and present with his computer work. He can be contacted at 172 Dennis Drive, Williamsburg, VA 23185, (804) 229-7086.

Improvements were achieved through patch programs, which were merged with the original and succeeding versions of the shoestring desktop publisher.

Patching has been a relatively easy and efficient way to bring you each new version. Furthermore, patching as a means of evolution has enhanced the operation and versatility of the desktop publisher. However, it has consumed most of the remaining available CoCo memory and has been far from efficient in memory usage.

The original desktop publisher programs — *Desktop Low* for the CoCo 1 and 2, and *Desktop High* for the CoCo 3 — were nearly equivalent, feature-for-feature. Evolutionary improvements were made in such a way as to preserve the equivalency of features. Because of this equivalency restriction, the original program did not take advantage of many of the special capabilities of the CoCo 3 that are lacking in the CoCo 1 and 2. Reprogramming *Desktop High* from scratch, to include its evolutionary enhancements while taking full advantage of CoCo 3 special capabilities, has materially improved and simplified operation of the desktop publisher. Moreover, it has substantially increased the possibility of further evolution. The result, *Ultralace*, is exclusively a CoCo 3 program. (Unfortunately, reprogramming *Desktop Low* has not proven to be a feasible undertaking.)

Ultralace Advantages

The development of *Ultralace* allows those of you who missed out on *Desktop High* a chance to join the ranks of those enjoying the many uses for desktop publishers. And *Desktop High* enthusiasts now have the opportunity to upgrade to what is presently the ultimate shoestring desktop publisher.

Ultralace, unlike *Desktop High*, does not require switching to ancillary BASIC programs to perform screen dumps or to make ASCII word-processor files compatible. Some of the advanced features and improvements found in *Ultralace* are:

☞ Built-in, high-capacity, high-quality, multi-column screen dumps.
☞ Automatic screen-margin settings and automatic allocation of screens to appropriate columns.
☞ The ability to accept ASCII word-processor files as input.
☞ 64 built-in clip-art designs, varying in size from 16 by 16 pixels to 192 by 192 pixels.
☞ Capacity to quickly handle any of 25 different fonts (sets of type characters).

Because of its length, *Ultralace* will be presented in a series of articles. This month and next, we'll develop and describe the programs employed by *Ultralace* for generating auxiliary files. Further in the series, we'll explain how to use *Ultralace*.

Two versions of *Ultralace* are presented over the course of this series. One version is for those who have older Tandy DMP-series printers. The second version is for users of other 9-pin dot-matrix printers (generally Epson/IBM-compatible printers). [*Editor's Note: If you own a Tandy printer that supports an IBM-compatible mode, we recommend you switch to that mode and use the latter version for better results. Doing this may require that you use a serial/parallel converter to drive the Tandy printer's parallel interface.*]

Building the Fonts

As its name implies, `GENFMENU` (Listing 1) generates the font menu for *Ultralace*. The font menu displays examples of the available fonts by printing the word "Font" onscreen in each of the 25 *Ultralace* typestyles. Each font is labelled with a letter, from A to Y.

In `GENFMENU`, strings `C$(1)` through `C$(25)` are used to draw the representations of the 25 available fonts. The strings `L$(1)` through `L$(25)` draw the letter labels A through Y. Each of the strings is appropriately identified by a REM statement at the end of the program line.

Format two disks before you enter the `GENFMENU` listing. Use one disk for the programs presented in this and next month's installments (the Program Disk). Use the second disk to hold the files these programs generate (the File Disk). After entering the `GENFMENU` listing, save it on the Program Disk, then enter `RUN"GENFMENU"`. You will see the font menu formed on the screen. If any of the 25 font representations or any of the 25 letter labels appear incorrectly drawn, press BREAK and answer the ensuing prompt by pressing N. Check the line containing the string corresponding to the erroneous word "Font" or its letter label. After all corrections have been made, save `GENFMENU` again and run it. This time after the font menu has been drawn, press `BREAK`, insert the File Disk in your disk drive, and answer the prompt by pressing Y. `GENFMENU` saves the file `FMENU.HR1` on the disk.

The programs in Listings 2 and 3 generate two of the 25 font files. These two programs, `GENFONTI` and `GENFONTN`, generate the Font I (`FONTI.DAT`) and Font N (`FONTN.DAT`) font files. It should be pointed out that `FONT1.DAT` and `FONT2.DAT` from *Desktop High* are precisely the same as `FONTA.DAT` and `FONTB.DAT` for *Ultralace*. You can use those files with *Ultralace* by merely renaming `FONT1.DAT` and `FONT2.DAT` to `FONTA.DAT` and `FONTB.DAT`, respectively.

Those of you who purchased the first *Desktop High* font disk need not enter the listing for `GENFONTI`. Also, those who bought the supplementary font disk need not enter the listing for either `GENFONTI` or `GENFONTN` — these are the same as `FONT9.DAT` and `FONT14.DAT` from *Desktop High*. In fact, the *Desktop High* font files `FONT1.DAT` through `FONT19.DAT` are exactly the same as *Ultralace* font files `FONTA.DAT` through `FONTS.DAT`. `FONT0.DAT` and `FONT10.DAT` of *Desktop High* are the same as `FONTJ.DAT` of *Ultralace*. To use any of the *Desktop High* font files with *Ultralace*, follow this procedure: If you have only one disk drive, insert the disk containing `FONT2.DAT`, for example, in Drive 0. To make this font file available to *Ultralace* as `FONTB.DAT`, type

```
RENAME "FONT2.DAT" TO "FONTB.DAT
"
```

and press ENTER. Now enter `COPY "FONTB.DAT:0"`. The computer instructs you to replace the disk in your drive with the destination (*Ultralace*) disk. Make the replacement, and the copy process continues until completion. If you have two drives, the renaming process is unnecessary because you can rename the file using the `COPY` command. For the same example, enter

```
COPY "FONT2.DAT:0" TO "FONTB.DAT
:1"
```

where the source and destination disks are the *Desktop High* disk and the *Ultralace* File Disk, respectively.

Fonts I and N are the only fonts to be provided in this series. The 23 other fonts are available from me. The final paragraph of this article provides the information necessary to purchase font disks.

In `GENFONTI` and `GENFONTN`, the strings `F$(1)` through `F$(84)` are used to draw the 84 characters in Fonts I and N. Each line containing one of these strings identifies the associated character with a concluding REM statement. If you enter more than one of these listings in this article at one sitting, be sure to use the `NEW` command before typing each successive program.

After you enter `GENFONTI`, save it on the program disk and run it. After three rows of Font I characters are drawn on the screen, press BREAK. If the characters seem to have been properly drawn, place the File Disk in the disk drive and press Y. However, if there is a noticeable error, press N. Check the line containing the string associated with the erroneous character. After making the correction, save `GENFONTI`, run it again, and scan the screen to determine whether or not you are ready to save `FONTI.DAT`. Treat `GENFONTN` in a similar way. The characters of Font N have been drawn double sized on the screen to help ease the process of scanning the characters for irregularities.

RAINBOW ON TAPE Users

While *Ultralace* requires a disk drive, the files used to form the *Ultralace* package are included on RAINBOW ON TAPE. You must load these files and save them to disk before using them.

Next Time

Ultralace keeps 64 different designs — patterns and little works of art — in memory. The designs are stored in screen memory as the Design Menu. Next month we'll present the listings to create this menu and other support files for Ultralace.

In the meantime, three font-file disks are available from me at the address given above: Fonts T through Y ($5), Fonts J through Y ($12) and Fonts A through Y ($19). Please include payment to me by check or money order. ☐

CoCo 3 Disk

40	63
90	30
130	69
180	164
210	121
250	170
320	228
420	148
520	66
580	35
END	177

Listing 1: GENFMENU

```
10 CMP:CLEAR900:DIML$(25),C$(25)
,M(25):PALETTE0,63:PALETTE1,0
20 C$(1)="BU2BR2G3ERE2R4GNL3G4D5
EU4BR2D5G4UH2LG2ER3FERE2URUE2NFG
2U4E4F2DH2DFBR5BD2G2ND4LD4NHFRE2
NU5RU4FBR5BU2G2RD4NHFNEU4NU2E3ND
6FNFD6E2BR5BU9G3LR3NR2NUD8NE2H2R
U5"'FONTA
30 C$(2)="BL2R6NDNGL5D3NR3D3NLR2
HU4BR8BDND3GD2FR3NU3EU2HL2BR6D4R
U4R3D4RU3BR5BU3ND5G2NR4FD2FRE"'F
ONTB
40 C$(3)="BU5R5BR2DNLNRDRNRDRE2B
L7L5DLNGBR5G2ND8GD8BDBL2L2DR2DFN
DRURE2U9NE3RD3ND4REFBR8BU3G2ND6L
D5LF2RE2NU7RU6FBR4BU2NG2D3E3DRFL
D7NE2HNU6BL2GNU5LNHU7BR12BU6G2RD
11NE2H2RU8L2R5"'FONTC
50 C$(4)="BL2BU2R11D2RHL2BL6D6R3
D2ENRHL3D6GU13LBR15BD3G3D2F3R5E3
U2H3L4G3D2F3R3E3U2H2BR6BUR3GNLD7
RU5NU2E3R2DRD7LNUE2U4BR6BU4DLGR7
NR5G5UNE2FDRDRDR4E2"'FONTD
60 C$(5)="BL2NR6D8RU4NU3R3BR4BUN
D4GD3FR4NU5EU3HL3BR7D5RU5R4D5U4B
R5BU4D7FRHU5NL3NR2U2"'FONTE
70 C$(6)="BL2BUR7NDL6D8NLR2HU3NU
3R3NUDBR5BU2ND4GD3FR4NU4EU3HL3BR
7RD5NLR2HU3ER3D5NLR2HU3BR6BU4D8R
EBL3U4NR3NL2U2"'FONTF
80 C$(7)="R4NFL4G2D2NR3D4BR10BU6
G2D2F2R2E2U2H2LBR7ND6FER2F2D4BR4
BU8DND7GR4"'FONTG
90 C$(8)="NGR3NR4D4L2NGR3NU3NR2D
2HD2GL3BR13BU6G2DED2R3E2UGU2L2BR
7NGD4RUNU3E3RD4RNEU3BR5BU3D6R2NE
L2HU4GR4"'FONTH
100 C$(9)="BR2BU2NG3NR7ND3FD3NR4
L3NGR3ND7LD8GL3BR14BU9G3NRF2NU3R
3E2NU2LU3L2BR7G2RD3RU2NU2E3RD5RN
E2U4BR6BU2NG2D2NR2ND3LD3FR2E2"'F
ONTI
110 C$(10)="NR3D2NR2D3BR6BU3GDFR
EUHBR4D2NDE2FD2BR4BU5D2NLNRD2FE"
'FONTJ
120 C$(11)="BD2BR12BU4RFND9ER2FN
DL6RD3NLR4DNDL4D5LR3BR7BU7G2D3F2
RE2U3H2G2D3FREU3HBR5BUGRD6RU6FE2
D7RU6BU3BR5DLGRD6FNRU7R"'FONTK
130 C$(12)="BUBR12R5NDL4D3R2DBL2
D3LR3BR5BU5GD3FR2EU3HNLBR3RD5NLN
RU3E2RFD4LR2BR3BU7D2NR2NLD4FRE"'
FONTL
140 C$(13)="BU2BR12D13R3U5R3U3L3
U2R4U3NL7BR4BD3G2D6FNU7FR2ENU7EU
6H2NLBR5BDRD8LR4LNU8LU8R5D8NLR3L
NU7LU8BR6BU5D4NL2NR3D11FNU16R2EU
3"'FONTM
150 C$(14)="BR12ND6NR3RD3NRD3BR5
BU4GD2FNU3R2EU2HND3NLBR3D4RU4R2D
4RU3BR3BU3D2NLNR2D3FNRU6"'FONTN
160 C$(15)="BU3BR19GL4G2ND3BR2D4
R3NEL4RD5GBR14BU8GL3G2D3F2R2E2U5
BR4BUFD6NGU3E3RNED6FBR5BU11D2R2N
EL3GBR2D6F2"'FONTO
170 C$(16)="BUBR12NR4D3NR3D5RU3B
R5BU2D5RNU2R4U5NL5BR3D5RU2BU3R4N
D5BR4BU3D2NLNR2D6R2HU"'FONTP
180 C$(17)="BU3BR13GDF2DBR3R2D3G
2NL3E2U3NR2UEU2HNL6BR7BD4G2D3FR2
E2U3HNLBR4RFGD3GBR4R2NEL2UEU3HNL
BR7BU2D2NL2NR2D2GD3LR3E"'FONTQ
190 C$(18)="BU3BR12D2RD10LNU2R3N
U2LU6NR3UNR3U3R4DRU2NL7UNL7BR4BD
4GD6FNU8R5ENL6UNL6U6NL6HND7NL5BR
6GD8LNU2R3NU2LU8NR5ER3D9LNU2R3NU
2LU8BR5BU3D2NLNR2DNLNR2D8LNU2R3N
U2LU11"'FONTR
200 C$(19)="BU2BR16NFG3DNR3D5NGB
R8BU6G3D2FRE2U3HBR7G3ND3E3FND5BR
5BU2DNR2NG2D5G"'FONTS
210 C$(20)="BU6BR9NR11D17RU16RD1
6RU16RD16RU11NR6U5BR15BD3R4FRF2D
FD3GDG2LGL3U12LD12HU11LD11HU9GD7
U2HU3BU4BR19D13RU13RD13RU13RD13R
U10NU3E3NDRND2RD13RU13FD12RU12FD
11BR7BU17D4NL3NR8D10FDU16RD17RU1
7RD17RNU17NER3E2"'FONTT
220 C$(21)="BU2BR11RD10LR2U10RD1
0R2HU9R6NGD3BL2D4HU2GLBR9BUGD4FU
5ED6R2U6LR2D6EU4BU2BR7D7LU6L2FD5
LR5U6NGRD6R2HU4BR7BU5D10RNEL2U8G
2RNR3D5"'FONTU
230 C$(22)="BUBR12R5DGD2HL2NU2D4
RL2BR11BU5R2FD3GL2HU3BUBR9FD4LR2
BR2NRU4HLBR8BUGR2GD3F"'FONTV
240 C$(23)="BU2BR12R7D2BD8BL5L2E
U5NU3R4DU2BR8R3F2D3G2L3H2U3EBUBR
10RFER2F2D5RL2BL4L2EU5BR12BU4D3N
L2NR4D5F2R2E"'FONTW
250 C$(24)="BU6BR11D15RU15RD15BR
2U10NR4U5R6BR7BD5R4F2DFD2GDG2L3N
U9LHU8GD6UHU2BU4BR14D10RU10RD10B
R2U10FERF2D8BR7BU13D11FU12RD13R2
NHBR2R2EBL4HU7NL6NR2U4"'FONTX
260 C$(25)="BUBR10RD8LR2U8RD8RHU
3R2DU2BL2U3R4D2HBR6BDGD4FU5ED6R2
U6LR2D6EU4BUBR3RD6LR2U6RD6BR2U6N
GRD6R2HU4BR6BU3D8RNEL2U7GNR4LFD4
"'FONTY
270 L$(1)="BR3RFL3D3GDLUENR5UER3
DRD3RU"'A
280 L$(2)="R5ND6FDGNL4FDGL5EU4RD
4"'B
290 L$(3)="BR2R3NDNFL3G2D2F2R3NU
NEL2H2U2E"'C
300 L$(4)="R4NDF2ND2LD3LDL4EU4RD
4"'D
310 L$(5)="R6NDNGL5D3NR3D3NLRNU5
R4UL"'E
320 L$(6)="R6NDNGL5D3NR3D3NLR2HU
4"'F
330 L$(7)="BR2R3NDNFL3DLND4GD2F2
NUR3U3NLRD3"'G
340 L$(8)="D6RU3NU3R4U3LD6RU2"'H
350 L$(9)="R3NR2D6NR2LNL2U5"'I
360 L$(10)="BR3R2ND5GD5L3U2LD"'J
370 L$(11)="RD6NLRU3NU3R2F2DLUH2
E3NLDG"'K
380 L$(12)="RD6NLR5U2G2L2U6R"'L
390 L$(13)="D6RU5F2NLNDNRE3D6LU4
"'M
400 L$(14)="D6RU6F2NLDNFR3U3LD6R
U2"'N
410 L$(15)="BR2NDG2ND2RD3RDR2URN
U3EU2H2LF"'O
420 L$(16)="R5ND2FDGL3D3NRL2EU4R
D"'P
430 L$(17)="BR2DLND3GD2F2NUR3DNR
U2NLNU3EU2H2NDL"'Q
440 L$(18)="RD6NLRU6R3ND2FDGNL2N
GD2FRH"'R
450 L$(19)="BRR3NDNFL3ND2GDFNER2
DR2DNLGL3UL"'S
460 L$(20)="NDR5NDL2D6NRL2EU4"'T
470 L$(21)="ND5RD6R3U6RD6"'U
480 L$(22)="NDRD3ED3ED2RNU2EU3FU
3RD"'V
490 L$(23)="ND6RD6E2NLNUNRF2U6RD
6"'W
500 L$(24)="F6RH3NH3E3LG6RE2"'X
510 L$(25)="NDRD2RDRD3NLR2HU2E3L
FG2"'Y
520 WIDTH40:CLS:HSCREEN3:ON BRK
GOTO 620
530 Y=-8:FORI=0TO4:Y=18+Y:HDRAW"
BM62,"+STR$(Y)+L$(I+1)+"BM88,"+S
TR$(Y)+C$(I+1):NEXT
540 Y=-8:FORI=5TO9:Y=18+Y:HDRAW"
BM170,"+STR$(Y)+L$(I+1)+"BM196,"
+STR$(Y)+C$(I+1):NEXT
550 Y=-8:FORI=0TO4:Y=18+Y:HDRAW"
BM278,"+STR$(Y)+L$(I+11)+"BM288,
"+STR$(Y)+C$(I+11):NEXT
560 Y=-8:FORI=5TO9:Y=18+Y:HDRAW"
BM380,"+STR$(Y)+L$(I+11)+"BM390,
"+STR$(Y)+C$(I+11):NEXT
570 Y=-8:FORI=0TO4:Y=18+Y:HDRAW"
BM494,"+STR$(Y)+L$(I+21)+"BM504,
"+STR$(Y)+C$(I+21):NEXT
580 GOTO580
590 FORJ=1TO1000:NEXT:CLS:LOCATE
4,8:PRINT"THE FONT MENU IS NOW B
```

```
EING SAVED":LOCATE4,10:PRINT"AS
FMENU/HR1."
600 POKE&HFFA2,&H70:SAVEM"FMENU/
HR1",&H4000,&H5FFF,&HAC73:POKE&H
FFA2,&H7A
610 END
620 HSCREEN0:CLS:LOCATE3,10:PRIN
T"READY TO SAVE THE FONT MENU? (
Y/N)"
630 K$=INKEY$:IFK$=""THEN630ELSE
IFK$<>"Y"THENENDELSE590
```

16	65
32	114
46	164
62	19
78	128
94	80
110	35
126	166
142	70
158	50
176	251
END	223

Listing 2: GENFONTI

```
1 WIDTH40:CLS:LOCATE11,8:PRINT"G
ENERATE FONTI":LOCATE9,10:PRINT"
BY H. ALLEN CURTIS":LOCATE11,12:
PRINT"COPYRIGHT 1990"
2 ON BRK GOTO220
8 DIMF$(84),M(84)
9 D=15:S=8
10 M(1)=15:F$(1)="BRBD2NGR6DGDGD
2NR4LDG2NL2BR10RNE2HLU2GU3GU3GU2
"'A
12 M(2)=12:F$(2)="BRBD2NGR10D2ED
G2NL4DRDLDGL4NU7LNGU7"'B
14 M(3)=7:F$(3)="BR3BD2NR4G3ND5R
D6RDRDR3E"'C
16 M(4)=12:F$(4)="BRBD2NGR8DRDRD
RD2HD2G2L7NGEU6RD6"'D
18 M(5)=8:F$(5)="BR2BD2R5DRBL7GR
DRDNR4G2RGRDR6E"'E
20 M(6)=11:F$(6)="BRBD2NGR3NR7ND
3FD3NR4L3NGR3ND7LD8GL3"'F
22 M(7)=8:F$(7)="BR3BD2NR4G3ND2R
D3RDRDR3E2NU2D5G2L6"'G
24 M(8)=14:F$(8)="BR12BDNR2GD8RN
E2L2U4NU3L5NU4D3G2NL2EU8L3G"'H
26 M(9)=5:F$(9)="BD2R2D8NL2NR3EU
7R2"'I
28 M(10)=7:F$(10)="BR6BD2NG2ND10
RD10G3L4"'J
30 M(11)=16:F$(11)="BRBD2NGR4GD7
GNL2E2U2NU4RF6RH7ERERENRHR4"'K
32 M(12)=12:F$(12)="BR3BDNR2GND7
GD8LR4FR2FR2FR"'L
34 M(13)=19:F$(13)="BR17BDNR2GD8
RNE2L2U7GDLDLDLDLNDLULULULUH2L3N
GR3D8GNL2E2U5"'M
36 M(14)=14:F$(14)="BR12BDNR2GD8
RNE2L2U3NU4GULULULUH2L3NGR3D8GNL
2E2U5"'N
38 M(15)=8:F$(15)="BR3BD2G3ND2RD
3RDRDR3E2U4LULUL2"'O
40 M(16)=12:F$(16)="BRBD2NGR10FD
HD2GL5NU3D4LNGU7"'P
42 M(17)=8:F$(17)="BR3BD2G3ND2RD
3RDRDR3G2NL2F2NR2ULHE4U4LULUL2"'
Q
44 M(18)=15:F$(18)="BRBD2NGR3NR7
D8NGRU4NU3RF7R2LH7R3E2ULD"'R
46 M(19)=8:F$(19)="BR2BD2R5NFL5G
2D2R2GNU3R2DR2DR2GR2D2HD2GL5H"'S
48 M(20)=11:F$(20)="BRBD2NGR5NR5
D8RNEL3EU6"'T
50 M(21)=9:F$(21)="BRBD2NGD7RNU7
DR2E3U5RD7RGLU2"'U
52 M(22)=11:F$(22)="BR10BDGR2GDG
DGDGDLU3GU3GU2LU2GUG2"'V
54 M(23)=18:F$(23)="BR17BDFL2FDG
DGDGDLU3GU3GU2L2GDGDGDLU3GU3GU2L
U2GUG2"'W
56 M(24)=11:F$(24)="BRBDNGRNF4DF
3DNG5E5NRG4DRDRDRDRE"'X
58 M(25)=9:F$(25)="BRBD2NGND5RD6
RDRDR3E2NU5D5G2L5"'Y
60 M(26)=9:F$(26)="BRBD2NGR8G8LN
E7R2FR4E"'Z
62 M(27)=8:F$(27)="BR2BD5NR4G2ND
2RD3RE4LD3FNE2U3"'a
64 M(28)=6:F$(28)="BR2NR3G2ND8RD
8R3E2NU2LU3LG2"'b
66 M(29)=6:F$(29)="BR2BD5NR4G2ND
2RD3R4E"'c
68 M(30)=8:F$(30)="BR7NRG2RD8NE2
```

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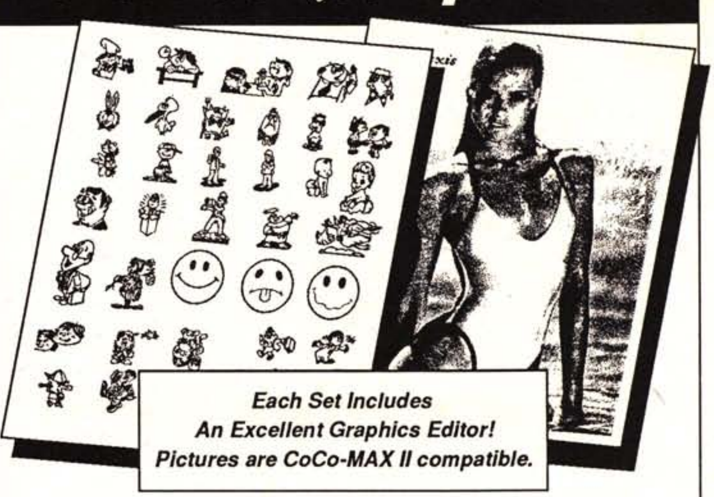

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```
HU4NU2L3G2ND2RD3RE2"'d
70 M(31)=6:F$(31)="BR2BD5R3FNLG2
L3U2GD2RDR4E"'e
72 M(32)=6:F$(32)="BR3BD2NR3G3RD
9GEU9FR2"'f
74 M(33)=7:F$(33)="BR3BD5NR4G2D2
FNU3G2RGRDRDR3E2U7LDNG3D6"'g
76 M(34)=8:F$(34)="BR2NR3G2ND8RD
6ND2E3RD5RNU3E2"'h
78 M(35)=4:F$(35)="BR2BD2GBD2NGD
5RNE2U5"'i
80 M(36)=2:F$(36)="BRBD3RBD2D8NG
2LU8G"'j
82 M(37)=8:F$(37)="BR2NR3G2D8RU2
NU6RUE2RDRDLGLF2UFE2"'k
84 M(38)=3:F$(38)="BR2NRG2D8RNE2
U8"'l
86 M(39)=14:F$(39)="BR2BD5G2RD3R
U2NU2E3RD5RU2NU2E3RD5RNE2U4"'m
88 M(40)=9:F$(40)="BR2BD5G2RD3RU
2NU2E3RD5RNE2U4"'n
90 M(41)=7:F$(41)="BR3BD5G3NRF2N
U3R3E2NU2LU3L2"'o
92 M(42)=7:F$(42)="BRBD5NGD10EU6
NU3E3RDRD2HD2GL2"'p
94 M(43)=7:F$(43)="BR2BD5NR4G2ND
2RD3RE4NLD8NEGU7"'q
96 M(44)=7:F$(44)="BRBD5NGD5RU2N
U3E3R2"'r
98 M(45)=7:F$(45)="BRBD5R4NFL4GR
DR2DR2DRGL4H"'s
100 M(46)=6:F$(46)="BR2BD4NG2D2N
R2ND3LD3FR2E2"'t
102 M(47)=8:F$(47)="BRBD5NGD4FNU
5RE4ULD4R2GU4"'u
104 M(48)=8:F$(48)="BRBD5NGNDRD3
ED3RE4L2E"'v
106 M(49)=13:F$(49)="BRBD5GRED3E
D3RE2UF2LFRE4L2E"'w
108 M(50)=9:F$(50)="BR2BD5NG2DRD
R2G3NLE5NRGDGDRDRE2"'x
110 M(51)=7:F$(51)="BRBD5NGD4FNU
5RE4ND7ULD9GL3"'y
112 M(52)=8:F$(52)="BRBD5NGR6G5L
NE4R6E"'z
114 M(53)=5:F$(53)="BR2BD5G2D2FN
U3R3E2NU2LU3L2BD2D"'0
116 M(54)=2:F$(54)="BRBD5NGD5RU5
"'1
118 M(55)=6:F$(55)="BRBD5NGR3D2E
DGLGLGR5E"'2
120 M(56)=5:F$(56)="BRBD5NGR3DRD
LDNL2FND2LD3GL3"'3
122 M(57)=7:F$(57)="BR4BD5G4R4NU
3D4EU3NR2U4"'4
124 M(58)=6:F$(58)="BD5NR6D3ENUD
R3DRFLDGL4"'5
126 M(59)=6:F$(59)="BR4BD5G3R4FN
D2LD3GL3U4LD3"'6
128 M(60)=6:F$(60)="BRBD5NGR5DG3
LNE3DRGLD3LNUE2"'7
130 M(61)=6:F$(61)="BR2BD5G2RDRN
F3DG2DED2R3E2H2E2LELHL"'8
132 M(62)=6:F$(62)="BR2BD5G2ND2R
D3R3G4RE5NU3LU4L2"'9
134 M(63)=2:F$(63)="BRBDGR2D4GNU
4BD2GR2G"'!
136 M(64)=6:F$(64)="BR2D2HD2GBR4
E2U2GD"'"
138 M(65)=9:F$(65)="BR3BDD9GU3NL
2NR8U4NU2L2R8NR2ND6U3GD9"'#
140 M(66)=6:F$(66)="BR4D4E2LU2G2
LG2RDR2DR2FLDLGD4EU3FNRL4H"'$
142 M(67)=10:F$(67)="BR10G8BR5EF
GBL8E8BL7GFE"'%
144 M(68)=9:F$(68)="BR3BD2RNDFG3
U3GFDG2NDRD2R3E2RDR2GH4RFRE2L2"'
&
146 M(69)=2:F$(69)="BRD3GE2UL2"'
'
148 M(70)=5:F$(70)="BR3BDNR2G3D3
RNU3D2RNUDRDR2"'(
150 M(71)=5:F$(71)="BDR2DRND2FD2
ND4RD3G3L2"')
152 M(72)=7:F$(72)="BRBD5F2E2RG2
NR3NF2G2LE2L3"'*
154 M(73)=5:F$(73)="BR3BD5GRD2GU
2L2R5"'+
156 M(74)=2:F$(74)="BRBD8GR2DNLG
2"',
158 M(75)=5:F$(75)="BD7R5"'-
160 M(76)=2:F$(76)="BRBD9DRGH"'.
162 M(77)=10:F$(77)="BR10DG10UE9
"'/
164 M(78)=2:F$(78)="BRBD4GR2GBD3
GR2G"':
166 M(79)=2:F$(79)="BRBD4GR2GBD3
GR2GRG2"';
168 M(80)=4:F$(80)="BR3BD4G3F3RH
3E3"'<
170 M(81)=5:F$(81)="BD6NR5BD3R5"
'=
172 M(82)=4:F$(82)="BD4F3G3RE3H3
"'>
174 M(83)=6:F$(83)="BRBD2NGR4FDH
D2LDLDBD2GR2G"'?
176 M(84)=13:F$(84)="BR5BD2GLG3N
D4RD5RDRFR5EREBL3BUU4HND4L2G2ND2
RD3E2R2FE2NU3RU3HLHL4"'@
200 X=16:Y=16:PALETTE0,63:PALETT
E1,0:HSCREEN3:FORI=1TO84:HDRAW"B
M"+STR$(X)+","+STR$(Y)+F$(I):X=X
+M(I)+4:IFI=26 OR I=52THENY=Y+24
:X=16:NEXTELSENEXT
210 GOTO210
220 HSCREEN0:CLS:LOCATE3,10:PRIN
T"READY TO SAVE FONTI/DAT? (Y/N)
230 K$=INKEY$:IFK$=""THEN230ELSE
IFK$<>"Y"THENEND
240 CLS:LOCATE2,10:PRINT"YOU ARE
 NOW SAVING FILE FONTI/DAT"
250 OPEN"O",#1,"FONTI"
260 FORI=1TO84:PRINT#1,F$(I):NEX
T
270 FORI=1TO84:PRINT#1,M(I):NEXT
280 PRINT#1,D:PRINT#1,S:CLOSE#1
```

18	120
38	12
56	237
72	216
90	182
106	128
122	58
138	12
156	33
174	75
END	97

Listing 3: GENFONTN

```
1 WIDTH40:CLS:LOCATE11,8:PRINT"G
ENERATE FONTN":LOCATE9,10:PRINT"
BY H. ALLEN CURTIS":LOCATE11,12:
PRINT"COPYRIGHT 1990"
2 ON BRK GOTO220
8 DIMF$(84),M(84)
9 D=9:S=8
10 M(1)=4:F$(1)="BRGD5RU6R2FD5LU
3NL2U3"'A
12 M(2)=4:F$(2)="R3FDGNL3FDGNU6L
3U6RD6"'B
14 M(3)=4:F$(3)="BRR2NFL2GD4FNU6
R2E"'C
16 M(4)=4:F$(4)="R3FD4GNU6L3U6RD
6"'D
18 M(5)=3:F$(5)="NR3D6NR3RU3NRU3
"'E
20 M(6)=3:F$(6)="NR3D6RU3NRU3"'F
22 M(7)=4:F$(7)="BRR2NFL2GD4FR3U
3LD3L2U6"'G
24 M(8)=4:F$(8)="D6RU6LBR3RD6LU3
NL2U3"'H
26 M(9)=1:F$(9)="RD6LU6"'I
28 M(10)=4:F$(10)="BR3RD5GNU6L2H
URD2"'J
30 M(11)=4:F$(11)="D6RU2E3ULDG2U
3NLD3RF2DLUHNUL"'K
32 M(12)=3:F$(12)="D6NR3RU6L"'L
34 M(13)=6:F$(13)="ND6F3D2H3UF3U
E2URD6LU4G2"'M
36 M(14)=4:F$(14)="ND6F4NU4D2H4U
F4"'N
38 M(15)=4:F$(15)="BRGD4FR2EU4HL
2D6R2U6"'O
40 M(16)=4:F$(16)="R3FDGNU3L3ND3
U3RD3"'P
42 M(17)=4:F$(17)="BRGD4FNU6RFNR
UNLEU4HNL2D6"'Q
44 M(18)=4:F$(18)="R3FDGNL3FD2LU
6L3D6RU6"'R
46 M(19)=4:F$(19)="BRR2FHL2GDF3D
L2NHR2EUH3LF4"'S
48 M(20)=5:F$(20)="R3D6LU6R3"'T
50 M(21)=4:F$(21)="NRD5FNU6R2EU5
LD6"'U
52 M(22)=4:F$(22)="NRD6RNU6RE2U4
LD5"'V
54 M(23)=7:F$(23)="NRD6RNU6R2U6R
D6NLRE2U4LD5"'W
56 M(24)=4:F$(24)="NRD2FGD2RU3NU
3R2D3RU2HEU2LD4"'X
58 M(25)=5:F$(25)="NRD2FNU3FD2RU
2ENL3EU2LD3"'Y
60 M(26)=4:F$(26)="R4D2G4NR4U2E4
DG4"'Z
62 M(27)=4:F$(27)="BD2BRR2FD3L3H
END2R3LU2D4"'a
64 M(28)=4:F$(28)="NRD6R3EU2HND4
L3RNU2D4"'b
66 M(29)=4:F$(29)="BD2BRR2NFL2GD
2FR2NEL2U4"'c
68 M(30)=4:F$(30)="BR3RD6LNU6L2H
U2END4R2"'d
70 M(31)=4:F$(31)="BRBD2GD2FNR2U
4R2FDNL4LU2"'e
72 M(32)=3:F$(32)="BR2NRG2R3LNU2
D4LU5"'f
74 M(33)=4:F$(33)="BRBD2GD2FNU4R
2D2NL2EU4HND4L2"'g
76 M(34)=4:F$(34)="NRD6RU6D2R2FD
3LU4"'h
78 M(35)=1:F$(35)="RBD2D4LU4R"'i
80 M(36)=3:F$(36)="BR2RBD2D5GLNH
RU6R"'j
82 M(37)=4:F$(37)="NRD6RNU6U2E2R
```

```
G3U2F3LH2"'k
84 M(38)=1:F$(38)="D6RU6L"'l
86 M(39)=7:F$(39)="BD2NR6D4RU4R2
D4RU4R2FD3LU4"'m
88 M(40)=4:F$(40)="BD2NR3D4RU4R2
FD3LU4"'n
90 M(41)=4:F$(41)="BRBD2GD2FNU4R
2EU2HND4L2"'o
92 M(42)=4:F$(42)="BD2R3FD2GNU4L
2NU4D2LU6"'p
94 M(43)=4:F$(43)="BRBD2GD2FNU4R
2D2RU6LND4L2"'q
96 M(44)=3:F$(44)="BD2RD2NE2D2LU
4"'r
98 M(45)=4:F$(45)="BRBD2NR2GF2RD
NL2EH2L2RF2"'s
100 M(46)=3:F$(46)="BRD2NLNR2D3F
NRU6L"'t
102 M(47)=4:F$(47)="BD2NRD3FNU4R
3U4LD4"'u
104 M(48)=4:F$(48)="BD2NRD4RNU4R
E2U2LD3"'v
106 M(49)=7:F$(49)="BD2NRD4RNU4R
2U4RD4NLRE2U2LD3"'w
108 M(50)=4:F$(50)="BD2NRDFGDRUN
U3ENHEURDGNLFDLU2"'x
110 M(51)=4:F$(51)="BD2NRD3FNU4R
2D2NL2EU5LD4"'y
112 M(52)=3:F$(52)="BD2R3DG3NR3U
E3"'z
114 M(53)=4:F$(53)="BRGD4FR2EU4H
ND6L2D6"'0
116 M(54)=3:F$(54)="BR2G2R2U2RD6
LU6"'1
118 M(55)=4:F$(55)="BRNGR2FD2G3N
R3LE3U3"'2
120 M(56)=4:F$(56)="R4DGNLFD2GNU
6L2H"'3
122 M(57)=4:F$(57)="BR2G2D2NR4R2
D2NU6RU6L"'4
124 M(58)=4:F$(58)="NR4D2R3FD2GN
U4L2H"'5
126 M(59)=4:F$(59)="BRNR2GD4FNU6
R2EU2HND4L2"'6
128 M(60)=4:F$(60)="R4D2G2D2LU2E
2U2"'7
130 M(61)=4:F$(61)="BRGDFGDFNU6R
2EUHNL2EUHND6L2"'8
132 M(62)=4:F$(62)="BRGD2F2DNLE2
U3HL2D4R2U4"'9
134 M(63)=1:F$(63)="RD4LNU4BD2DR
UL"'!
136 M(64)=4:F$(64)="D2RU2LBR3D2R
U2L"'"
138 M(65)=6:F$(65)="BR3DR3LNUL4R
D2L2RNDR2NDRNRU2"'#
140 M(66)=4:F$(66)="BR2D8ULNHR2E
UNL2HNHL2HNR2UER2F"'$
142 M(67)=5:F$(67)="BRGFENHERDG2
DGND2E3NUG2DF2EHG"'%
144 M(68)=4:F$(68)="R2D3FNRDFL3N
U4HUE2L2U2"'&
146 M(69)=1:F$(69)="RD2LU2"''
148 M(70)=2:F$(70)="BR2G2D4FNU6F
"'(
150 M(71)=2:F$(71)="F2D4GNU6G"')
152 M(72)=4:F$(72)="BR2DNG2NF2D2
NH2NE2D"'*
154 M(73)=4:F$(73)="BR2BDD4U2NL2
R2"'+
156 M(74)=1:F$(74)="BD5DRUNLD2G"
',
158 M(75)=3:F$(75)="BD3R3"'-
160 M(76)=1:F$(76)="BD5RDLU"'.
162 M(77)=3:F$(77)="BR3DGDGDGD2U
EUEUEU"'/
164 M(78)=1:F$(78)="BDRDLUBD4RDL
U"':
166 M(79)=1:F$(79)="BDRDLUBD4RD2
NGULU"';
168 M(80)=3:F$(80)="BR2BDRG2F2LH
2E2"'<
170 M(81)=4:F$(81)="BD2R4BD2L4"'
=
172 M(82)=3:F$(82)="BDF2G2RE2H2L
"'>
174 M(83)=4:F$(83)="BRGRUR2FDG2B
D2DLUNRBU2E3DH2"'?
176 M(84)=6:F$(84)="BR2G2D2F2R3B
U2RU3HL3RBD2GFENFUL"'@
200 X=16:Y=16:PALETTE0,63:PALETT
E1,0:HSCREEN1:FORI=1TO84:HDRAW"B
M"+STR$(X)+","+STR$(Y)+F$(I):X=X
+M(I)+4:IFI=26 OR I=52THENY=Y+24
:X=16:NEXTELSENEXT
210 GOTO210
220 HSCREEN0:CLS:LOCATE3,10:PRIN
T"READY TO SAVE FONTN/DAT? (Y/N)
230 K$=INKEY$:IFK$=""THEN230ELSE
IFK$<>"Y"THENEND
240 CLS:LOCATE2,10:PRINT"YOU ARE
 NOW SAVING FILE FONTN/DAT"
250 OPEN"O",#1,"FONTN"
260 FORI=1TO84:PRINT#1,F$(I):NEX
T
270 FORI=1TO84:PRINT#1,M(I):NEXT
280 PRINT#1,D:PRINT#1,S:CLOSE#1
```

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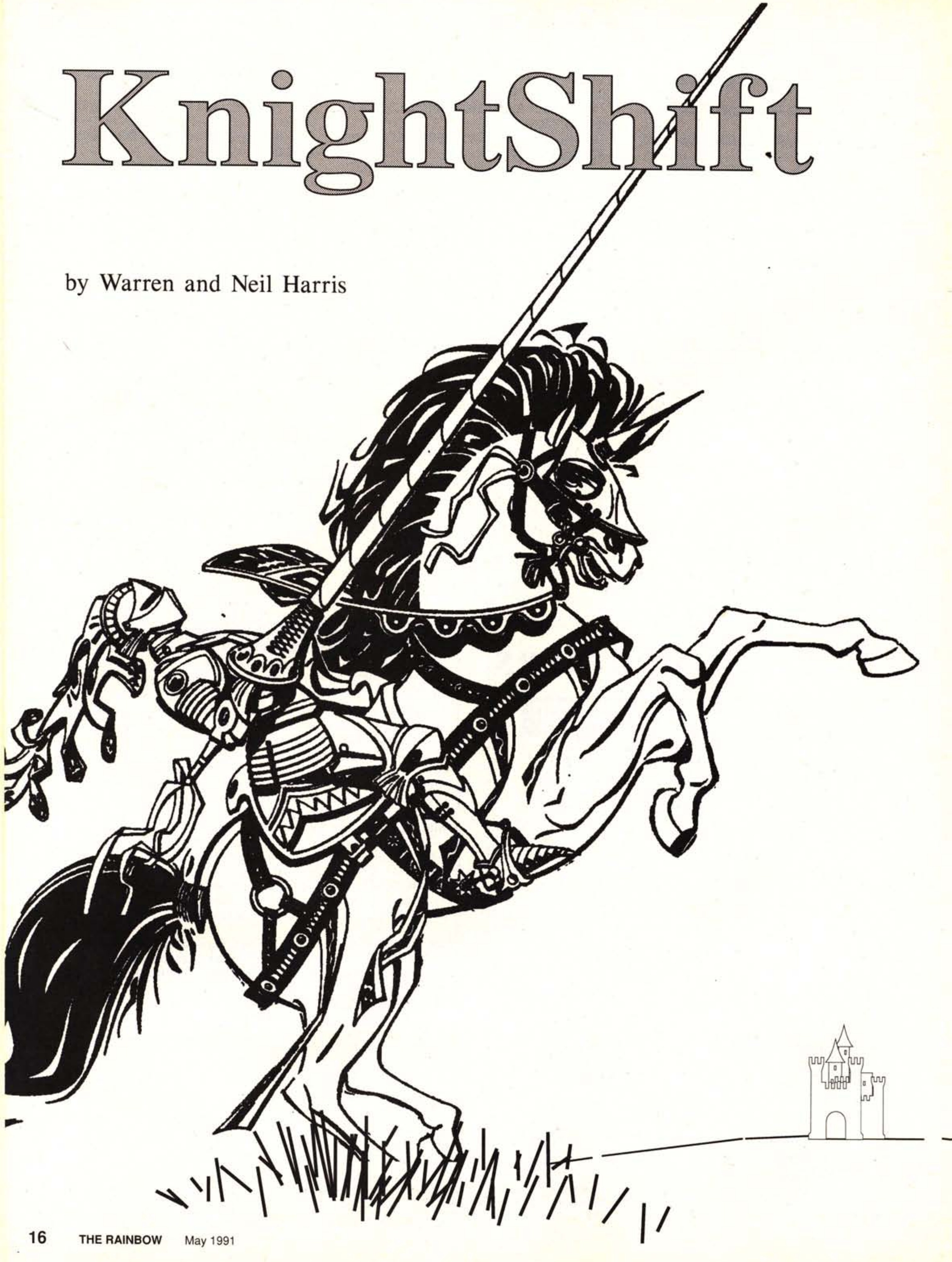
KnightShift

by Warren and Neil Harris



In the many kingdoms of Europe in the mid-sixteenth century, there rose two great men of seemingly equal power and wealth. When they did collide on that fateful day in the dead of winter, neither knew of the other's existence, or of the power and dreams of men as callous and merciless as themselves. Each was a warlord to be reckoned with, and each came to battle until the last castle of his foe did fall . . .

Overview

KnightShift is a game for two players that requires one *pair* of joysticks and Extended Color BASIC. Written for `PMODE 3`, the colors are vivid and very pleasing when viewed on a color television, although other monitors work, as well.

`HP()`	start points for grid block
`A$`	castle
`AR$`	shield shell
`TI$`	title page
`MV$`	move
`PY$`	player
`AK$`	attack
`BK$`	joystick box
`M$(1)`	Player 1
`M$(2)`	Player 2
`X(),Y()`	player coordinates

Figure 1: Important Variables

The playing area is arranged in a familiar grid scheme. Each square marks the boundaries of each kingdom. The king who captures all the castles surrounding the other king, preventing him from moving to any other castle, wins the game. On each turn, each king must move to an adjacent unoccupied square and capture one castle. If a king is surrounded, or if he cannot capture any castle other than one that causes him to be completely surrounded, he loses the battle. (And if ye followed that, Sir Graham, ye are a better man than I).

The game may require a preliminary session to fully understand the strategies involved. You are not allowed to make an illegal move. If you attempt an illegal move, the computer sounds a warning beep. It takes a fair amount of strategic captures to box your opponent into a moat from which he can never escape. With luck, my friend, ye shall survive.

Playing KnightShift

Each king begins at his end of the battlefield. At his turn, he can only move to one

Line	Description
120	CoCo 3 check, redefine color
180	set up playing field
290	Player 1 move
300	Player 2 move
310	Player 1 select grid
320	Player 2 select grid
520	playing loop
530	joystick sampling routine
640	Player 1 shield draw
650	Player 2 shield draw
660	next player swap
670	validate legal move
680	validate legal kill
690	display winner, play again?
760	display title
860	display overview

Figure 2: Important Routines

Warren and Neil Harris both have degrees in computer science and are ex-Radio Shack employees who have owned Color Computers since its introduction. Currently, they are developing computerized-interviewing expert systems for the Ottawa Civic Hospital in Ottawa, Canada. You can contact them at Unit B, 8 Woodvale Green, Nepean, ON K2G 4G8, Canada; (613) 723-7252.

32K Extended

120	172
180	191
240	101
300	166
370	201
440	11
480	250
560	59
620	180
690	46
760	253
830	151
880	122
END	187

The Listing: `KNIGHT`

```
10 'KNIGHT SHIFT
20 'WRITTEN BY NEIL AND WARREN
   HARRIS
30 'COPYRIGHT (C) APRIL 1991
35 'BY FALSOFT, INC.
40 'RAINBOW MAGAZINE
50 CLEAR2000
60 SD(1)=150:SD(2)=87
70 FORT=1TO7:READHP(T):NEXT
80 DATA 7,43,79,115,151,187,223
90 PL=1:X1=4:Y1=30:X2=4:Y2=180
100 PL=1:X(1)=4:Y(1)=30:X(2)=4:Y
(2)=180
110 PMODE3,1
120 PCLS:IF PEEK(33021)=50 THEN
PALETTE 5,3:POKE 65497,0 ELSE PO
KE 65495,0
130 S1=100:S2=100
140 S$="BM0,32"
150 A$="U10;L2;U3;R4;D2;U2;R4;D2
;U2;R4;D3;L2;D10;L8;R25;U10;R2;U
3;L4;D2;U2;L4;D2;U2;L4;D3;R2;D10
;R3;L3;U7;L9;BL4;L1;U1;R1;D1;BR1
7;R1;U1;L1;D1;BD3;BL8;L1;D4;R1;U
4;D4"
160 AR$="BR3;U15;R4;D1;R9;U1;R4;
D15;L1;D1;L2;D1;L2;D1;L7;U1;L2;U
1;L2;U1;L1"
170 GOSUB 760
180 FORT=30TO190STEP25:SOUNDT,1:
DRAW"C2;BM0,"+STR$(T)+";BR6;XA$;
BR23;XA$;BR23;XA$;BR23;XA$;BR23;
XA$;BR23;XA$;BR23;XA$;":NEXT
190 PY$="BM0,7;C2;U7;R5;D4;L5;BR
7;BU4;BR4;D7;R4;BR6;U7;R4;D7;U3;
L4;BR9;BU4;D3;BF1;R3;E1;U3;BG2;B
D2;D3;BR8;U7;R4;BD7;L4;U3;R2;BR8
;D3;U7;R4;D4;L3;F3"
200 P1$="BM68,7;R4;L2;U7;L1;G1;B
D6"
210 P2$="BM68,7;R4;L4;U3;R4;U4;L
4;BD7"
220 MV$="BM210,7;U7;F3;E4;D7;BR6
;R5;U7;L5;D7;BR13;H2;U5;BR5;D5;G
2;BR8;U7;R4;BD7;L4;U3;R2"
230 BX$="BG5;R33;U23;L33;D23"
240 AK$="BM200,7;U7;R4;D7;U3;L4;
BR9;BU4;R4;L2;D7;BR8;U7;L2;R4;BR
```

of the castles (squares) adjacent to him, either up, down, left, right, or on the diagonal. Use the joystick to move to the square you want to capture and press the joystick button. You cannot move to a square that has already been captured and bears either your shield or your opponent's.

After moving to a "safe" castle, you can capture any castle along a straight line from your position. Again, move the joystick until your square surrounds the castle you want to capture. If it does not surround a square that is in a direct line from your position, the computer acknowledges this with a warning beep. If you have made a legitimate move, press the joystick button again to capture that castle. The castle is then covered by your shield.

The game ends when one of the two kings is completely surrounded by captured castles (shields). The key to the game is that if the king cannot move, he is dead.

And on that note, we bid you farewell and the best of luck. ❑

```
6;R4;D7;BL4;U7;D4;R4;BR6;D3;R4;B
U7;L4;D3;BR12;E3;BL5;D3;R1;F4;BL
5;U5"
250 MN$="BR5;R15;H1;U2;H1;U2;H1;
U1;R3;U3;L3;D2;L3;U2;L3;D2;L3;U2
;L3;D4;R3
260 M$(1)="BR5;BU2;U15;R4;D1;R9;
U1;R4;D15;L1;D1;L2;D1;L2;D1;L7;U
1;L2;U1;L2;U1;L1;BD1;E16;BL7;BD5
D1;U1;BU5;BL8;F16"
270 M$(2)="BR5;BU2;U15;R4;D1;R9;
U1;R4;D15;L1;D1;L2;D1;L2;D1;L7;U
1;L2;U1;L2;U1;L1;BR8;BD3;U17;D7;
L7;R14"
280 GOTO330
290 SOUND 87,1:SX=X(1):SY=Y(1):G
OSUB650:DRAW"D15;C0;XM$(1);":RET
URN
300 SOUND 87,1:SX=X(2):SY=Y(2):G
OSUB650:DRAW"D15;C3;XM$(2);":RET
URN
310 DRAW "BM"+STR$(HP(X(1)))+","
+STR$(Y(1))+";C0;XBX$;C1;":RETUR
N
320 DRAW"BM"+STR$(HP(X(2)))+","+
STR$(Y(2))+";C3;XBX$;C2;":RETURN
330 DRAW"XPY$;"
340 GOSUB290:PL=2:GOSUB300:PL=1
350 SOUND 200,1:GOSUB310:SOUND18
8,1:GOSUB320:IFPL=1THENDRAW"C2;X
P1$;":ELSEDRAW"C2;XP2$;"
360 DRAW"C2;XMV$;":SX=X(PL):SY=Y
(PL):GOSUB530
370 IFSX=X(PL)ANDSY=Y(PL)THEN360
:ELSEIFSX+1<>X(PL)ANDSX-1<>X(PL)
ANDSX<>X(PL)THENGOSUB550:GOTO370
:ELSEIFSY<>Y(PL)ANDSY+25<>Y(PL)A
NDSY-25<>Y(PL)THENGOSUB550:GOTO3
70
380 GOSUB670:IFP<>5THENGOSUB550:
GOTO370
390 DRAW"BM"+STR$(HP(SX))+","+ST
R$(SY)+";C1;BL2;BD2;XM$(PL);BM"+
STR$(HP(SX))+","+STR$(SY)+";C2;B
L1;XA$;":ON PL GOSUB290,300
400 SOUND24,1:DRAW"C1;XMV$;C2;XA
K$;":SX=X(PL):SY=Y(PL):SOUND24,1
410 GOSUB530
420 IFPL=1ANDX(1)=X(2)ANDY(1)=Y(
2)THENGOSUB550:GOTO420:ELSEIFSX=
X(1)ANDSY=Y(1)THENGOSUB550:GOTO4
20
430 GOSUB670:IFP<>5THENGOSUB550:
GOTO420
440 IFSX=X(PL)ANDSY=Y(PL)THEN410
:ELSEIFSX=X(PL)ORSY=Y(PL)THENGOS
UB660:GOSUB650:GOTO460
450 GOSUB660:FORT=1TO7:IFSX+T<>X
(PL)ANDSX-T<>X(PL)THENNEXT:GOSUB
660:GOSUB550:GOTO420:ELSEIFSY-(T
*25)=Y(PL)ORSY+(T*25)=Y(PL)THEND
RAW"BM"+STR$(HP(SX))+","+STR$(SY
)+";C1;":GOSUB650:ELSENEXT
460 IF PL=1 THEN CL=0 ELSE CL=3
470 DRAW"D13;R2;C"+STR$(CL)+";XA
R$;BM"+STR$(HP(SX))+","+STR$(SY)
+";C1;XBX$;C3":PAINT(HP(SX)+7,SY
-5),CL,CL
480 FORT=1TO2:H1=X(T):H2=Y(T):FO
RT2=-1TO1:FORT3=-1TO1:X(T)=H1+T2
:Y(T)=H2+(T3*25):GOSUB680:IFP<>5
THEN:NEXTT3:NEXTT2:GOTO690:ELSEX
(T)=H1:Y(T)=H2:NEXTT
490 DRAW"C1;XAK$;XP1$;XP2$;C0;":
IFPL=1THENPL=2:ELSEPL=1
500 GOTO350
510 GOTO360
520 POKE338,255:DRAW"C0;XMV$;":G
OSUB530:DRAW"C1;XMV$;C0;XAK$;":P
OKE338,255:GOSUB530:DRAW"C1;XAK$
;":GOTO520
530 LX=SX:LY=SY:IFPL=1THENFR=254
:JH=0:JV=1:ELSEFR=253:JV=3:JH=2
540 GOSUB310:GOSUB320
550 JX=X(PL):JY=Y(PL):POKE338,25
5:DD=JOYSTK(0):DD=JOYSTK(1):H=JO
YSTK(JH):V=JOYSTK(JV):ON PL GOSU
B320,310
560 IFH=63ANDLX<>7THEN:IFV=63AND
LY<180THENGOSUB640:LX=LX+1:LY=LY
+25:GOTO600:ELSEIFV=0ANDLY>30THE
NGOSUB640:LX=LX+1:LY=LY-25:GOTO6
00
570 IFH=0ANDLX<>1THENIFV=0ANDLY>
30THENGOSUB640:LX=LX-1:LY=LY-25:
GOTO600:ELSEIFV=63ANDLY<180THENG
OSUB640:LY=LY+25:LX=LX-1:GOTO600
580 IFH=63ANDLX<>7THENGOSUB640:L
X=LX+1:ELSEIFH=0ANDLX<>1THENGOSU
B640:LX=LX-1:ELSEIFV=63ANDLY<180
THENGOSUB640:LY=LY+25:ELSEIFV=0A
NDLY>30THENGOSUB640:LY=LY-25
590  IF PL=1 THEN CL=0 ELSE CL=3
600 IF LX<>JX OR LY<>JY THEN SOU
NDSD(PL),1:DRAW"BM"+STR$(HP(LX))
+","+STR$(LY)+";C"+STR$(CL)+";XB
X$;":
610 X(PL)=LX:Y(PL)=LY
620 IFPEEK(338)= FR THENFORT=175
TO125STEP-25:SOUNDT,1:NEXT:RETUR
N
630 GOTO550
640 DRAW"BM"+STR$(HP(LX))+","+ST
R$(LY)+";C1;XBX$;":RETURN
650 DRAW"BM"+STR$(HP(SX))+","+ST
R$(SY)+"C1;L2;":FORT=1TO13:DRAW"
R27;U1;L27":NEXT:RETURN
660 A=X(PL):B=Y(PL):X(PL)=SX:Y(P
L)=SY:SX=A:SY=B:RETURN
670 IFY(PL)<10ORY(PL)>180ORX(PL)
<0ORX(PL)>256THENP=8:RETURN:ELSE
P=PPOINT(HP(X(PL))+11,Y(PL)-10):
RETURN
680 IFY(T)<10ORY(T)>180ORX(T)<0O
RX(T)>7THENP=8:RETURN:ELSEP=PPOI
NT(HP(X(T))+11,Y(T)-10):RETURN
690 CLS:IFT=1THENW=2:ELSEW=1
700 PRINT@72,"PLAYER ";W;" WINS"
:WN(W)=WN(W)+1:TI$="V31;T2;L40;O
2;G;P40;A;P40;L20;B;O3;P60;L10;E
;P40;L20;C;P70;L5;E;":PLAYTI$:PR
INT@163,"PLAYER 1 HAS WON ";WN(1
);" GAMES":PRINT@195,"PLAYER 2 H
AS WON ";WN(2);" GAMES"
710 PRINT:PRINT:PRINT"         PL
AY AGAIN"
720 POKE338,0
730 IFPEEK(338)=254THENA$="Y":GO
TO750
740 :A$=INKEY$:IF A$=""THEN730
750 IF A$="Y" THEN RESTORE:GOTO7
0 ELSE END
760 DRAW"BM70,93;S16;XA$;C6"
770 TI$="S2;D50;U30;E25;G25;F28;
BR15;U50;F30;D20;U50;BR20;D50"
780 DRAW"BM10,140;"+TI$
790 CIRCLE(76,152),15,6,1,0.05,.
8
800 TI$="BM88,154;H5;L10;G5;BD20
;BR30;U50;D25;R35;U25;D50;BR20;U
60;L220;BR220;R130;BL80;BD20;H10
;L5;G10;F10;R10;F10;D8;G15;L7;H1
0;BD10;BR80;U50;D25;L30;U25;D50;
BR50;U50;BR20;R25;BL25;D20;R20;B
L20;D30;BR45;U62;L40;R80"
810 DRAW TI$
820 SCREEN 1,1
830 TI$="V31;T2;L4;O2;D;P50;D;P5
0;D;L6;O1;B;P50;O2;L16;E;L4;D;P5
0;L6;O1;B;P50;O2;L16;E;L4;D"
840 PLAY TI$
850 FORT=1TO1000:NEXT
860 CLS:PRINT@32,TAB(10)"KNIGHTS
HIFT"
870 PRINT@96," IN THE 13TH CENTU
RY, TWO KINGS  SOUGHT TO EXPAND
THEIR DOMAINS  AND SET OUT TO CA
PTURE CASTLES  BELONGING TO ANY
MEMBERS OF  A  ROYAL FAMILY.   T
HE VICTORIOUS"
880 PRINT" KING WOULD BE HE WHO
WAS LAST   TO ATTACK OR CAPTURE
A CASTLE."
890 PRINT:PRINT" THE RULES WERE
CLEAR- MOVE ONE  CASTLE PER DAY
(MOVE)  -  AND  ATTACK HORIZONT
ALLY,VERTICALLY  AND DIAGONALLY
ONLY.   CHARGE!"
900 POKE 338,0
910 IF PEEK(338)<>254 AND PEEK(3
38)<>253 THEN 910
920 PCLS:SCREEN1,1:DRAW"S4;C0;":
RETURN
```

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BreakPoint

Graphics Functions

by Greg Law
Technical Editor

Creating your own C library isn't nearly as difficult as many people believe. The first step is to create the source code for each of the functions and compile the source code into a series of object files. Once the object files have been created and debugged, each object file is merged into a single library module. In this series, I will demonstrate the techniques used to create a library using the window and graphics functions documented in the OS-9 Level II manual, as well as system calls and Get Status and Set Status calls.

Before actually creating the source code, refer to the Windows section of the OS-9 Level II manual. The graphics functions listed here are handled by writing a string to the desired window. The easiest functions to write are those that do not require any parameters, such as `DWEnd`. As a matter of fact, `DWEnd` can be handled either as a function or as a macro (see Figures 1a and 1b). But what, exactly, is a macro?

Most computer-related dictionaries define macro with a very terse and imprecise definition that may leave you more confused than ever. The following is typical:

1. A large mainframe computer facility able to handle very large volumes of data. 2. A single instruction as written in source code, which may require a number of successive operational machine steps to execute, each step involving a machine instruction in microcode; a macroinstruction. 3. A group of often-used instructions treated as a unit entity.

Unfortunately, this type of definition is all too common with computer dictionaries.

According to the first definition, most data processing centers around the world are macros. According to the second definition, a common instruction supported by any compiler is a macro. According to the third definition, any group of instructions used more than once in a program is a macro. It should be obvious that these definitions miss the mark by a country mile. (These definitions are like saying a swimming pool is a large mass of water or that a whale is a fish over four feet in length.) In our context, a macro is a label that is used in place of a user-defined string and may be loosely defined as *shorthand notation* or *mnemonic notation*. The following are all examples of valid macros:

```
#define TRUE 1

#define EQUAL ==

#define COPYRIGHT "Copyright (c)
 1991 Falsoft, Inc."
```

A specific example of using these macros might be

```
if(Init EQUAL TRUE)
     printf(COPYRIGHT);
```

In this case we can say that `TRUE` and `EQUAL` are mnemonic notation because `TRUE` and `EQUAL` make more sense in the given context. We can also say that `COPYRIGHT` is shorthand notation because it involves a lot less typing, although it may be more mnemonic as well. Therefore, we can say that macros may make your source code easier to understand, and they may save a lot of typing — but I don't recommend using macros simply for the sake of saving keystrokes. Let's look at the output of the C preprocessor for the above example:

```
if(Init == 1)
  printf("Copyright (c) 1991 Fal
soft, Inc.");
```

If you are a veteran programmer, you may easily understand either version. But the novice will likely understand the first version much more quickly. Another advantage of using macros is that it may make your source code much easier to modify. As a simple example, assume that several routines in your source files print the version number of your program. If the version number is hard-coded in each routine, you have to search and replace each occurrence in every source file. On the other hand, if you define the version number as a macro, you can change only the macro and all occurrences change with it.

The differences between a macro and a function are generally in speed and memory requirements. A macro may be faster because no function calls are required, but its code is inserted into your program each time it is referenced. A function is somewhat slower, but only one copy of the function is included in the entire program. In the case of the macros discussed so far, the actual differences are minimal. In other words, there is very little difference (if any) in speed or memory requirements between the `DWEnd` macro and the `DWEnd` function. The reason there is little difference is because the `DWEnd` macro inserts the instructions to push the parameters on the stack

---

In addition to being OS-9 Online SIGop, Greg Law enjoys programming on all types of computers and has worked on systems ranging from the CoCo to the Burroughs B6700 super mainframe. He lives in Louisville, Kentucky.

and to call `write()`. On the other hand, when the `DWEnd` function is used, the instruction to call the `DWEnd` function is inserted into the assembly source. The actual requirements are approximately thirteen bytes for each `DWEnd` macro as opposed to four bytes for each call to the `DWEnd` function — a net difference of approximately nine bytes each.

```
DWEnd(path)
int path;
{
   write(path, "\x1B\x24", 2);
}
```

Figure 1a: DWEnd Function

```
#define DWEnd(path) write(path, "\x1B\x24", 2)
```

Figure 1b: DWEnd Macro

An alternative used by many libraries is to define both the macro and the function. The macro would be included in the `windows.h` file, and the function would be included in the library. It should be noted that macros always take precedence over functions in the library. This is because macros are converted into in-line code by the preprocessor. That is, if the original source code is

```
if(quit EQUAL TRUE)
{
      DWEnd(win1);
      exit(0);
}
```

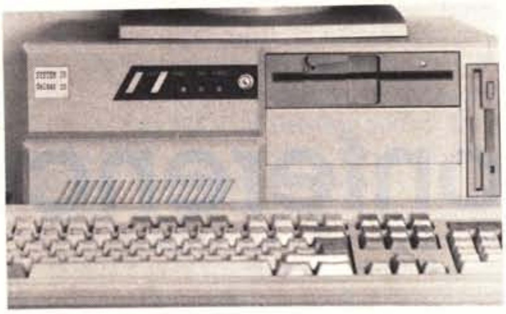
The source code passed to the compiler by the preprocessor might be

```
if(quit == 1)
{
      write(win1, "\x1B\x24", 2);
      exit(0);
}
```

In this case, you can see that `EQUAL`, `TRUE` and `DWEnd` are macros. However, you can tell the precprocessor to *forget* a specified macro by using `#undef`. If you find memory getting tight, you can undefine the macro by inserting `#undef DWEnd` into your source and the `DWEnd` function is used instead of the macro. Note that `#undef DWEnd` should be inserted into your source file after `#include <window.h>` (where the `DWEnd` macro is defined) and before the first reference to `DWEnd`. One drawback is that you need to insert the `#undef` statement into each source file that references `DWEnd`. Otherwise you may find some source files using the macro and others using the function, although it is perfectly legal to mix and match macros and function calls.

We'll continue next month with a discussion of parameters and how they need to be handled. Meanwhile, get a good book on C programming and study the chapters on the preprocessor. If you want to get ahead, study the chapters on passing arguments to functions, and typecasting. If you need a good book, consider *C: The Complete Reference* (*Turbo C: The Complete Reference* is the same book, except it contains information specific to Borland's *Turbo C* compiler for MS-DOS) and *The Complete Guide to C*. Both of these books contain approximately 500 pages with plenty of valuable information.

SYSTEM IV COMPUTER



THE **SYSTEM IV** is a high performance computer system based on the Motorola 68000 microprocessor operating at a clock speed of 16 MHz and has been designed to provide maximum flexibility and versatility. Microware's Professional OS9/68000 operating system is included with the **SYSTEM IV** providing an efficient multi-user and multi-tasking environment. This provides the user with a PC for home use, small business applications and a viable low-cost solution for many industrial control applications (embedded systems). Special requirements (such as midi, sound, A-D/D-A, net-working, etc.) are easily handled with readily available low-cost PC/XT boards which can plug into the **SYSTEM IV** expansion slots. And, as user requirements change or improved special function boards become available, they may be added or replaced at the user's option. Thus, when software requiring multi-media or other new capability becomes a reality, the user will be able to add that capability easily and have the latest technology at his disposal.

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OTHER OPERATING SYSTEMS may be installed. These include CPM, UNIFLEX, MINIX, STARDOS, REXDOS and most any other operating system capable of running on the 68000 microprocessor chip.

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THE MOTHER BOARD is a 4 layer XT size board which holds the microprocessor, sockets for up to 4 MBytes of 0-wait state RAM, a battery backed-up clock, 4 serial ports, 2 parallel ports, a high density (37C65) floppy disk controller, 7 PC/XT compatible expansion slots, a memory expansion connector to allow an additional 6 MBytes of 0-wait state DRAM, keyboard connector and the necessary system support chips.

THE TERMINAL SYSTEM includes the mother board with 1 MByte of onboard DRAM, a high density floppy disk drive (3 1/2" or 5 1/4"), 4 serial port connectors, a parallel printer port connector, a 200 watt power supply, mini-PC style case capable of holding 5 half-height drives and Professional OS9/68000. This configuration requires the use of an external terminal(s). You may use your existing CoCo, along with a suitable terminal program, as a terminal.

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Delphi Bureau

Conference Control

by Eddie Kuns
OS-9 SIG Database Manager

I have already described the basic slash commands and the general Conference slash commands. Now you're ready for the more complicated commands, some of which are fun-to-use. If you're playing *Dungeons and Dragons* and the dog just ate your dice, you can dial into Delphi and make all of your die rolls in Conference. For example, to roll four 20-sided dice and two 12-sided dice, enter:

```
/ROLL 4D20 2D12
```

The `/ROLL` command assumes a single, 6-sided roll, unless you give it other parameters. Along with the `/ROLL` command is the `/PROLL` command that gives you a private dice roll. The difference is that no other member of your Conference group sees the results. The `/GROLL` and `/NOGROLL` commands enable and disable, respectively, the ability of members of a specific Conference group to use `/ROLL` and `/PROLL`.

Another fun slash command for Conference is `/ACTION`. Try this command to see how it acts. To generate a string of actions, use `/NOACTION`.

If you want to enter several lines of text in Conference so they all appear at once, use `/QUEUE`. After entering this command, you can enter several lines of text and use the editor by entering `/EDIT`. The text is not sent until you press CTRL-Z. At that point, you are prompted for a brief description and everything you have typed is sent to everyone in your Conference group.

If someone is using a nickname in Conference and you want to know his Delphi username, you can enter:

```
/RNAME nickname
```

If you want to see all users' real Delphi usernames attached to every message they send, enter `/SHOWRN`. Turn this feature off with `/NOSHOWRN`. This setting lasts only as long as you stay in Conference.

If you are feeling especially brave and want to talk in more than one Conference group at a time, you can enter a new group without leaving the old one using the `/TALK` *group* command. You can specify the new Conference group by name or number, and if the name or number doesn't already exist, you create a new Conference group. When you are a member of more than one group, each message you see is preceded by the group number from which it was sent. The group you last "talked to" is the one to which your messages go. If you want to send a message to another conference group, you can either use

```
/TALK group
```

to change the current group, or send a message by typing the destination group number before the text of the message. For example:

```
/22 Hi, how's the weather in Cal
ifornia?
```

The above command sends the message to everyone in Conference Group 22.

I'll warn you ahead of time that belonging to more than one Conference group can be very confusing. But it can also be a lot of fun. When you exit, you only exit the group you are currently in. Once you have exited all conference groups, you pop up a level and become idle in Conference.

Delphi allows you to log conferences to your workspace with the `/LOG` command. To log to a specific filename, enter

```
/LOG filename
```

All group conversation is saved as text in the specified file. To stop logging, enter `/NOLOG`. However, the logfile is not actually closed until you leave Conference — if you enter `/LOG *` after entering `/NOLOG`, logging resumes at the end of the logfile opened earlier.

There are a couple of other useful Conference commands that gain access to your workspace. Entering

```
/DIRECTORY filename
```

causes Delphi to display a directory of your workspace that only you can see. You can use wild cards to see more than one file. If you have a file in your workspace you want to show everyone, simply enter

```
/DISPLAY filename
```

to list it to everyone's screen. Some people have cute pictures and messages they display this way. If you accidentally display the wrong file (say, that 2-Meg text file you uploaded for someone else), you can stop the display with the `/NODISPLAY` command.

Although there isn't a frequent use for private conferences, occasionally you want to talk to someone without anyone else being able to drop in uninvited. In this case, you want to make a Conference group private using the `/GPRIVATE` command. Any group that is created with `PRIVATE` as part of

---

Eddie Kuns is pursuing a PhD in physics at Rutgers University. He lives in Aurora, Illinois, and works as a programmer and researcher at Fermilab. Eddie is co-manager of the CoCo SIG; his username is EDDIEKUNS.

the group name is automatically private. You can enter a private group only if you are paged into it. The `/NOGPRIVATE` command makes a Conference group public.

Another way to make a group private is with the `/GPASS` command. This command sets a group password. To enter this type of group you must first provide the password by entering

`/PASS` *password*

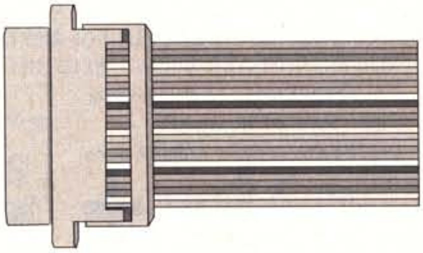
Once you have done this, you can use `/JOIN` or `/TALK` to enter the password-protected group. Once the need for privacy is over, use `/NOGPASS` to remove the restriction.

I'll finish the list of group commands with `/GLOCK` and `/GQUIET`. The group manager may use `/GLOCK` to prevent anyone else in the group from changing the conference group name, or any of the other group attributes. The group manager is normally the person who created the group, or the first person listed in the `/WHO` list for the group. Of course, `/NOGLOCK` allows other members in the group to modify the group name. Finally, if you don't want the conference disturbed by notices of people entering and leaving the group, the `/GQUIET` command disables those notices. Use `/NOGQUIET` to reenable them.

The conference software available on many systems allows you to gag a fellow Conference member (meaning you won't see any of his comments), although everyone else who hasn't gagged that person will. On Delphi, the

`/SQUELCH` *username*

command serves this purpose. You won't see what they say in Conference and you won't receive their messages either.



Entering `/SQUELCH` with no arguments shows the list of people you currently have squelched. Use

`/NOSQUELCH` *username*

if you change your mind. A similar command is `/GAG`, which prevents you from seeing messages sent via `/SEND` from anyone outside your Conference group. The `/NOGAG` command re-enables sends from everyone else. These settings last only as long as you remain in Conference.

The final Conference command I'll mention is, appropriately, `/BYE`. This command performs not only the same function as `/EXIT`, it also logs you off Delphi.

Database Information

Jeff Chapin has posted some fascinating news in both SIGs; ham radio is becoming more accessible. By the time you read this, ham radio licenses should be easier to earn.

In the OS-9 group, Philip Brown released a beta-test version of *Small-C*, which he ported to OS-9 with the help of several other people. Although *Small-C* doesn't support the full C standard, it's a good alternative for people who cannot find Tandy's C Compiler package, or who want to learn C and don't plan to write applications that need floating point numbers or structures.

Mike Sweet has updated his popular *Ed* editor by releasing version 3.1. Paul Seniura contributed documentation for *AciaPDS*, a new RS-232 driver. He's looking for answers to some questions to make this driver as compatible as possible.

In the OS-9 Patches database, Mark Far-

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rell posted a collection of patches to CC3IO and WINDINT that correct a number of known bugs. Dennis Skala and Mike Sweet uploaded patches to the Burke & Burke and Disto clock modules, respectively, which incorporate the software fix covered in the August 1990 issue of THE RAINBOW.

In the Telcom database, I released a new version of *Kermit* (Version 21.5) by Simmule Turner, which significantly advances the state of the art. Francis Swygert contributed the BITBANG driver, which offers some support for the serial port on the back of the CoCo 3 under OS-9 Level II.

If you want to see how a program autoboots when you enter DOS, you can use Dan Mondays' posting in the CoCo SIG Utilities and Applications database. This program loads a disk's boot track into memory where the DOS command loads it, and then saves it to a file on disk.

Charles Gibson posted a database program with an index to the files on RAINBOW ON DISK, as well as articles, hints and tips. It comes with five years of index information about THE RAINBOW!

Danny Fye uploaded a list of features offered by the latest version of *Autoterm* for those considering either upgrading or buying this telecommunications program. ❑

Database Report

OS-9 SIG

General Information

HAM RADIO LICENSE NEWS
TANGERINE Jeff Chapin

Applications

SMALLC — BETA TEST
THEFERRET Philip Brown
UNIX UTILITIES
DODGECOLT Mike Sweet
ED VERSION 3.1
DODGECOLT Mike Sweet
FONTMAN 1.31: FONT EDITOR
EARTHER Shawn Driscoll
EDICON 1.14: ICON EDITOR
EARTHER Shawn Driscoll
RAYTRACE BOUNCING BALL
MITHELEN Paul Jerkatis

Utilities

DAY OF THE WEEK
CHYDE Chris Hyde
LPR - UNIX PRINTING UTILITY
CHYDE Chris Hyde
EASYEDIT BOOTFILE EDITOR
RZAKER Bob Zaker
TSHELL DEMO
JSWIN John Swinson
FIXTXT, LF2CR - TEXT FILTERS
KINGTRENT Mike Huskey
CLS - CLEAR SCREEN
KINGTRENT Mike Huskey
PRF- A PRINTER SPOOLER
DODGECOLT Mike Sweet
DELTA
BRIANWHITE Brian White
FONTCRACK: SPLIT MERGED FONTS
EARTHER Shawn Driscoll
FONTSTRIP: STRIP FONT FILES
EARTHER Shawn Driscoll
GDMAP, SHOW GRAPHIC DISK BITMAP
XLIONX Mark W. Farrell

Device Drivers

NEW ACIA DRIVER DOCS - NEED HELP
PAULSENIURA Paul Seniura
720K RAM DISK
DOCBEAR John Wesson

Patches

BBCLOCK2.AR
DENNYSKALA Dennis Skala
MV2PAT.PAK
XLIONX Mark W. Farrell
NEW DISTO RTC CLOCK MODULES
DODGECOLT Mike Sweet
RAMMER PATCH
DOCBEAR John Wesson

Telcom

KERMIT RELEASE 21.5
EDDIEKUNS Eddie Kuns
ACCESS COLOR BBS V2.3
CSERINO Chris Serino
BITBANG.BAS
DSRTFOX Francis Swygert
TOP TEN USERS LISTER FOR ABBS
NES Eric Stringer
CHRISTMAS.B09
CLIFFORD Cliff Redding

Graphics & Music

CLIFFS OF DOVER, UME
6STRINGER Larry Williams
THE STRANGER, UME
6STRINGER Larry Williams
BALLAD (UMUSE) CASIO CT-630
DMACIAS David Macias
MORESONGS.AR
6STRINGER Larry Williams
ENTERTAINER.UME
6STRINGER Larry Williams
VICKY 4096 VF3
JOHNHOHN John Hohn
SAUCER — MVCANVAS DRAWING
BOBKEMPER Robert Kemper
FACE ON WALLS-BOUNCING BALL DEMO
GRAPHICSPUB Bob Montowski
PIANO CHRISTMAS SONGS BY DINO
07ESRTIMOTHY Tim Faddon
TALESPIN
045JOE Terry Woods
BOUNCING RAY BALLS DEMO
GRAPHICSPUB Bob Montowski
PIANO MAN, AND OTHER UME SONGS
6STRINGER Larry Williams

Programmers Den

CC SOURCE, DOCS, EXECUTABLE
EDDIEKUNS Eddie Kuns
NEW TEXT SPLIT
MISHOO Mike Shook

Grits & Gravy

THRO 'EM OUT!
POLTERGEIST Brian Wright
THE TWELVE DAYS OF XMAS
POLTERGEIST Brian Wright

CoCo SIG

General Information

NOCODE.TXT
TANGERINE Jeff Chapin

CoCo 3 Graphics

SEXY VANNA WHITE
SANNUCCI Joe Sannucci
ZMORE CM3 PICS BY HCR
HOWARDC Howard C. Rouse
ADULT MACNASTIE'S
SHARROD Scott Harrod
COCO3 GRAPHICS
HOWARDC Howard C. Rouse
WHO3.IMG
TRAS Richard P. Trasborg
AIRCRAFT CARRIER
HOWARDC Howard C. Rouse
XMAS EVE
HOWARDC Howard C. Rouse
PANDAS
HOWARDC Howard C. Rouse
COCOMAX ART BY HCR
HOWARDC Howard C. Rouse
2 SUPER ANIMATED DEMOS FOR 512K
SANNUCCI Joe Sannucci
640 3-D VIEWER
LDMOORE Larry Moore
WHO2.IMG
TRAS Richard P. Trasborg

Utilities & Applications

DOS TO DISK
DANMONDAY Dan Monday
RAINBOW FILES INDEX
CHASGIBSON Charles Gibson
BOWLING STATS V5.2
REDCOAT Don Joyce

Music & Sound

CHRISTMAS540.LYRA
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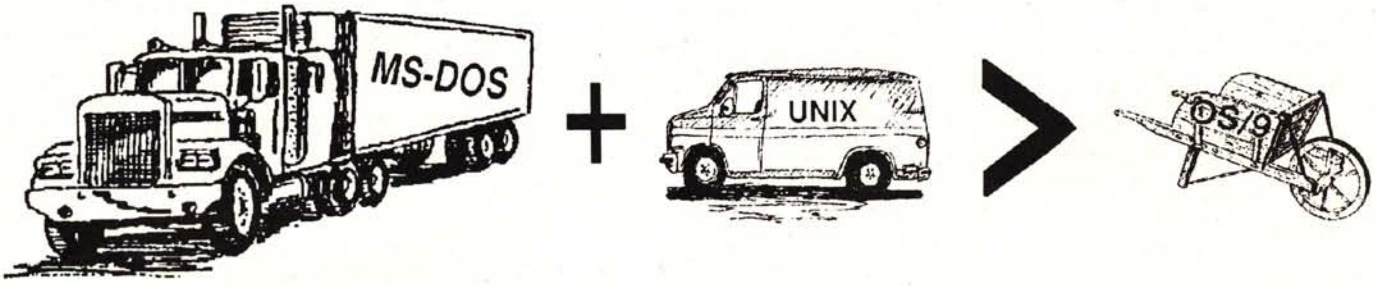

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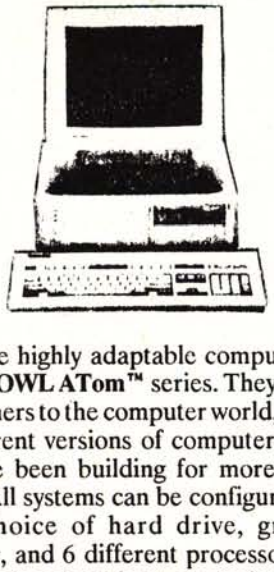

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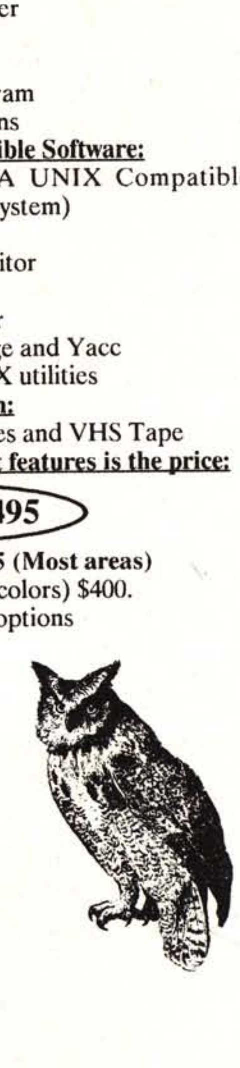

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A guide to printer terms and features

The Printer Primer

by Cray Augsburg

Many beginning computer users are happy just seeing the computer doing its thing and printing the results on the screen. At some point, however, these people realize they need a way to get a permanent copy of the computer's work. The goal of any printer is to provide you with a permanent and visible record of that work. Of course specific requirements often dictate what type of printer a user needs, and the world of printers is sometimes a mysterious one.

This article is not meant as a comprehensive buyer's guide for printers. Rather, it provides a general discussion of terms and features you'll encounter when considering the purchase of a printer. Also included is a feature comparison of some printers that are often used with the Color Computer.

Printers come in all shapes and sizes. In addition, they may use any one of several techniques to get images and text onto the paper. Each technique has specific advantages and disadvantages. For example, thermal printers, which literally burn tiny dots on special paper, are relatively inexpensive and very quiet during operation. They are very slow, however, and produce poor-quality printouts.

Cray Augsburg is RAINBOW's managing editor and has an associate's degree in electrical engineering. He and his wife, Ruth Ann, have two children and live in Louisville, Kentucky. His username on Delphi is CRAY.

Printer Glossary

ASCII — an acronym for American Standard Code for Information Interchange. A binary code used to communicate between computing devices. Each binary code represents a different character. ASCII was originally a 7-bit code allowing 128 characters or symbols, but it has been extended to use all eight bits to allow 256 distinct character representations. However, the symbols defined in the upper 128 positions (often called the extended character set) are not standardized. One printer might provide the IBM extended character set, another the Greek alphabet, and a third might offer publishing symbols.

Bidirectional Printing — a situation in which a printer's printhead prints as it moves from right to left as well as from left to right. This is faster than unidirectional printing, but at the cost of accuracy. Draft printing modes often use bidirectional printing to increase speed. See also *Unidirectional Printing*.

Bit Image — a term used to describe memory-mapped graphics in which specific memory locations control specific picture elements (pixels).

Buffer — RAM usually internal to the printer. This memory is where the printer stores incoming data and download-character definitions. Generally, the larger the buffer, the better off you'll be. However, buffer sizes of 2K or greater are usually sufficient for most CoCo-oriented text and graphics printing. If you anticipate printing a lot of large files, look for a larger buffer to decrease printing time, or consider purchasing an external data buffer. Also, download characters (especially NLQ-type) require a lot of internal buffer space. A buffer that holds only one line is considered unacceptable because the computer must wait on the printer before sending each line, thereby increasing print time. We'd rather have the printer waiting on the computer than the other way around. In Figure 1, the top number represents the size of the built-in buffer. The bottom number, if there is one, indicates the maximum buffer size supported by the printer through optional memory upgrades.

Character Matrix — the number of horizontal and vertical dots used to create the printed characters. These values (*horiz.* by *vert.*) are different for various style and pitch settings, as well as for different fonts.

Character Set — the set of alphanumeric characters and symbols the printer can print. This is not to be confused with a font, which specifies how the characters will look. The ASCII character set is standard. In addition, most printers also support the IBM extended character sets 1 and 2, which include many special symbols and graphics characters. Many printers offer support for International subsets, which are special symbols used in other countries.

Color — some printers come with the electrical and mechanical requirements for printing text and graphics in several different colors. These printers use a four-color (red, yellow, blue and black) ribbon to create color images. Generally they can print up to seven standard colors by mixing these inks. Through dithering (printing special dot patterns instead of saturating the area with a color), hundreds of different color shades are possible. In addition, single-color ribbons are often available for those printers that do support built-in color printing.

Control Codes — commands sent from the computer to the printer (via software or direct command entry) that manipulate printer functions (i.e. bold, italics, font changes, linefeed size, etc.). Control codes are generally the ASCII codes from 0 through 31 or an escape code (ESC) followed by a series of ASCII characters. These characters are not printed, rather they are interpreted and acted upon to control the printer.

Density (maximum) — the number of addressable, single dots the printer can print horizontally in a one-inch space (referred to as dpi). Most common printers for personal use are capable of printing 240 dots-per-inch. Standard laser printers offer a 300-

On the other hand, laser printers use a laser beam to draw an image on a copier drum. The image is then transferred to paper in much the same way a photocopier works. These printers are fast, quiet, and they produce excellent results. But those who have looked around can tell you just how expensive they are.

By far the most popular printers for use with personal computers are dot-matrix impact printers. Dot-matrix impact printers remain the most popular because of the balance they strike between expense and quality of results. (Albeit, they are usually more than a little noisy.) Dot-matrix impact printers use a series of pins to transfer an image onto paper through an inked ribbon. Each character or image is composed of a matrix of dots. (For more information about the different types of printers, read "Printer Overview" by Ed Ellers on Page 110 of the May 1988 issue.)

Keep in mind that while some terms and features are applicable to other printer types, the information presented here focuses on aspects of dot-matrix impact printers. The glossary included here defines many terms and features you'll encounter in the world of printers.

Printers and the CoCo

We are often asked if certain printers will work with the CoCo. The answer is simple — most any printer can be made to work with the Color Computer. However, you must take several things into consideration:

The Color Computer provides printer output through its built-in 4-pin serial port. Radio Shack is the only company that offers a printer with a similar port. If you plan to use another retailer's serial printer, you'll have to make a special cable. This is usually no more involved than matching the pinouts for the two serial ports and buying the appropriate connectors and wire. Marty Goodman often describes special printer cables in his monthly "CoCo Consultations" column.

However, most printers currently sold come with a parallel interface. Such an interface is more efficient, but causes obvious problems for CoCo owners — it takes more than a cable to hook a 4-pin serial port to a 36-pin parallel port (at least, if you want it to work). Not being a group to let adversity hold it down, members of the CoCo

dpi density. The letters on this page were printed by a Linotronics typesetter using a density of 1270 dpi.

Download Characters — bit-image printer characters you design to fit specific needs (e.g. math and electronics symbols; images for letterheads). Defining download characters is not overly difficult, but it is time-consuming and requires a lot of work, even when done by technically-oriented users. Defining a download font requires manually calculating which dots to print in the character matrix to form all characters for the font. This information is then sent to the printer via a program the user writes (usually in BASIC). Printers with greater amounts of memory often allow NLQ as well as draft definitions.

Draft — a single-pass print mode in which the characters are formed from the least number of dots necessary to still allow legibility (usually). This mode (which is loosely referred to as another font) is found in nearly all printers and is commonly used for first drafts (hence the name) and listings.

Emulation — the ability of a particular printer to understand and accept codes for another printer. For instance, saying a printer emulates the Epson LQ-850 implies that, through a special mode, you can send it in any code you can send to an Epson LQ-850 and you'll get the same result. Unfortunately, this is not always true. There seems to be a gray area in many cases in that some codes are supported for a given emulation, while others are not. However, CoCo users often find some sort of Epson/IBM emulation advantageous. Most CoCo software give better results using an Epson/IBM driver than a driver for Radio Shack's less-standard Tandy mode. (Tandy is moving away from designing a Tandy mode into the printers it sells.)

Escape (ESC) — an ASCII control code (its value is 27 decimal, 1B Hex) preceding many printer commands. It indicates to the printer that the following ASCII values are to be treated as commands rather than printable characters.

Font — an individual typestyle or collection of characters and symbols, all of the same size and style. Some examples of different fonts are: Times Roman, Courier, Prestige and Helvetica. Most NLQ printers offer some variety of fonts. Don't confuse the terms *font* and *pitch*, as some manufacturers do. Pica is not a font, it is a pitch. Bold and italic are not fonts, either, even though italic print is not supported for all fonts at all pitches on some printers.

Footprint — the width and depth dimensions of the printer. Although this is not usually a major factor, the printer you purchase may have to fit in a specific space on your computer desk.

Friction Feed — the ability of a printer to feed single sheets of paper that don't have "edgies." If you plan to use friction feed primarily for professional correspondence, see the printer in action before you buy it. Most of these paper-transport systems are accurate, but a shoddy transport gives you shoddy printouts.

Front-Panel Control — the ability to control certain functions (font, pitch, print quality, etc.) via switches on the printer's front panel.

Head Pins — the number of pins built into the printhead. In general, the higher this number, the cleaner the printed characters. While NLQ results from a 9-pin printhead are often quite good, NLQ text from a 24-pin printer usually looks much crisper. Printers with 24-pin heads print NLQ with one pass of the printhead, whereas 9-pin printers take two. This results in faster NLQ printing on 24-pin printers.

Italic — a style of type in which characters are printed at a right-slanting angle rather than straight up and down. The italic style is not always available for all fonts, pitches and emulations.

Logic Seeking — the ability of the printer to "look ahead" at the incoming data and avoid moving the head to "print" spaces at the beginning or end of a line. The head is moved as little as possible, thereby decreasing overall print time and wear on the carriage mechanism.

NLQ (Near Letter Quality) — A printing mode in which characters are formed from a greater number of dots than in the draft mode. The resulting characters are much crisper in appearance. For 9-pin printers, each NLQ line is usually printed in two passes, while 24-pin printers take only one pass. Therefore, an important consideration for 9-pin printers is whether the printer operates in the unidirectional or bidirectional mode for NLQ. Bidirectional NLQ printing takes less time than unidirectional.

Panel Lock — a feature on most printers with extended front-panel control that allows you to "lock in" the selected features, overriding software commands intended to change them.

Paper Loading — on the chart this indicates whether paper is loaded from the front, rear or bottom of the printer. In many cases, this depends on the type of paper you are using. Single sheets are usually loaded from the top or from the front. Tractor-feed paper is usually loaded from the bottom or from the rear.

Paper Parking — a feature on many push-tractor feed printers that allows you to move loaded fanfold paper temporarily out of the way, making room for single sheets without unloading the fanfold paper altogether (a time-consuming process). This is not usually important for home use, but businesses and some other users find paper parking a handy feature. Paper parking also allows you to "unload" the paper during extended periods of non-use. As this moves the paper away from the platen, it prevents the paper from becoming unnaturally warped or curved.

Paper Width — The maximum paper width the printer accepts. In Figure 1, the top number is for fanfold paper (with edgies) and the bottom number is for single sheets. In earlier days, printers were labelled as 80-column or 132-column. These labels are based on the number of pica (10-pitch) characters the printer could print on one line. Condensed-pitch modes on most current printers eliminate the need for the wider paper carriages in many cases.

Parallel Interface — a parallel interface is standard on most printers. This is usually a Centronics parallel port using a 36-pin connector. Electrical considerations of the interface and the cable usually limit the length of the computer/printer cable to 12 feet. Longer cable lengths often result in unreliable operation. If you need more distance, consider using a serial interface. CoCo users need some form of serial-to-parallel converter to use the parallel interface. See the section on serial/parallel converters in this article.

Pitch — the number of alphanumeric characters printed per inch (cpi). Pica refers to 10-cpi printing, while elite means 12 cpi. Most printers are capable of some form of condensed (16.67- or 17-

	Number of Head Pins	Buffer Size	Parallel Interface	Serial Interface	Maximum Dot Density	Color Support	Print Speed (cps) at 10 cpi	Print Direction	Friction Feed	Tractor Feed	Tractor Push/Pull	Paper Parking	Paper Loading	Footprint	Suggested Retail
Tandy DMP-107	9	One Line	S	S	240	No	100	Bi - draft Uni - NLQ & graphics	Y	Y	Push	N	R	15" x 10"	$279.95
Tandy DMP-134	9	8K 40K	S	N	240	No	160	Bi - draft Uni - NLQ & graphics	Y	Y	Push	Y	R	15" x 11"	$359.95
Tandy DMP-240	24	8K 40K	S	N	240	Opt. Kit	160 draft 53 NLQ	User-selectable	Y	Y	Push Pull	Y	R,B	15.8" x 12.6"	$549.95
Tandy DMP-302	24	16K	S	N	360	No	225 draft 75 NLQ	User-Selectable	Y	Y	Push	Y	R	15.7" x 13.6"	$599.00
Panasonic KX-P1124	24	6K 38K	S	O	360	No	160 draft 53 NLQ	User-selectable	Y	Y	Push Pull	Y	F,R,B	16.9" x 14.1"	$529.00
Panasonic KX-P1180	9	2K 34K	S	O	240	No	160 draft 32 NLQ	Bi - text Uni - graphics	Y	Y	Pull	N	R,B	16.7" x 13.4"	$299.95
Star NX-1001	9	4K	S	O	240	No	150 draft 38 NLQ	Bi/Uni - draft Uni - NLQ & graphics	Y	Y	Push	Y	R	15.6" x 11.8"	$249.00
Star NX-1020	9	16K	S	O	240	7	150 draft 200 fast draft 38 NLQ	Bi/Uni - draft & NLQ Uni - graphics	Y	Y	Push Pull	Y	R,B	17.3" x 13.1"	$299.00
Star NX-2420	24	30K 62K	S	O	360	7	167 draft 222 fast draft 56 NLQ	User-selectable	Y	Y	Push Pull	Y	R,B	18.2" x 14.0"	$499.00
Citizen 200GX	9	8K	S	O	240	Opt. Kit	160 draft 213 fast draft 40 NLQ	User-selectable	Y	Y	Push Pull	Y	R,B	16.9" x 12.6"	$299.00
Citizen GSX-140	24	8K 40K	S	O	360	Opt. Kit	160 draft 53 NLQ	User-selectable	Y	Y	Push Pull	Y	R,B	15.8" x 12.6"	$499.00
Seikosha SP-2000	9	Unavailable	S	N	240	No	160 draft 40 NLQ	Bi/Uni - draft Uni - NLQ & graphics	Y	Y	Push	Y	R	15.0" x 11.0"	$329.00

Notes: The manufacturer's specs for the Tandy DMP-107 and DMP-134 provide no information about the conditions under which the print speed ratings were obtained.
All printers listed do provide user control of bidirectional/unidirectional printing. The defaults are specified for known cases.For those printers offering push- and pull-tractor feed, push feed is used for rear-fed paper and pull feed is used for bottom-fed paper. We were unable to determine the Seikosha SP-2000's buffer size before presstime.
S=Standard O=Optional F=Front R=Rear B=Bottom

Figure 1: Manufacturer's Specifications — Mechanical

Community developed serial/parallel converters that make connecting a parallel printer to the CoCo a snap. (See "Serial and Parallel" on Page 33.)

When connecting any printer to your computer, it is important that you take special care to properly set the printer's DIP switches. These switches control the emulation mode and default settings of the printer. More importantly, the CoCo does not send a linefeed code (LF) to the printer when it sends a carriage return (CR) at the end of each line. In other words, the printer moves the printhead to the start of the line, but does not advance the paper. Unless you want to see a solid black stripe across the page, set the DIP switches so the printer interprets all carriage returns as a carriage return plus a linefeed (CR/LF).

If you occasionally use a program that sends its own linefeeds, this setting causes

cpi) printing as well as other pitch settings. In changing pitches, the dots forming the characters are printed closer together, allowing more characters to fit into the same space.

Print Speed — a rating usually given in the number of characters printed per second (cps). Factors that affect overall print speed are buffer size, draft versus NLQ settings, and pitch selection. The ratings provided here are manufacturer's specifications. (Read that as "under optimum conditions.") Actual speed will most likely be lower, but you can use these numbers for the purposes of basic comparison. The ratings provided here are for a pitch of 10 characters-per-inch (also referred to as *pica pitch*). Because of the amount of data involved, printing graphics usually takes much longer than printing text.

Proportional Spacing — a variable-pitch mode in which each character is assigned a specific width rather than having a uniform width. For example, a "w" is assigned more space than an "i".

Push/Pull Tractor — a push-tractor feed is a paper-transport mechanism in which the paper goes through the tractor before it rolls around the platen (the big rubber wheel where all the action takes place). The paper is pushed through the printer. A pull-tractor feed is a mechanism by which the paper is pulled across the platen by the tractor. Most bottom-feed printers use a pull tractor. Rear feed is supported by a push-tractor in some cases and a pull tractor in others. One advantage of the push-feed mechanism is that you don't waste as much paper. (With pull-tractor printers, after printing a page, the printhead is usually two or three inches down the next blank page. You waste a sheet every time you print a new document because you can't print at the top of the first page.) Another advantage of a push tractor in many cases is the inclusion of a paper-parking feature.

Quiet Mode — a mode in which the printer makes multiple passes and/or reduces the number of dots printed overall in an attempt to decrease the noise level. The trade-off is printing speed.

Resident Font — a font preprogrammed into a ROM in the printer (as opposed to a download font, which must be sent to the printer as data).

Serial Interface — might be necessary for longer distance applications. While some printers offer a serial interface (or optional serial/parallel-converting interface), only certain Radio Shack printers come equipped with a 4-pin DIN serial interface that works directly with the Color Computer. Most others use a 25-pin, DB-25 connector. You'll need to build a special cable to use these printers.

Suggested Retail — retail prices suggested by the manufacturers. Mail order and in-store prices are usually much lower. Check the ads and shop around to find the best deals.

Tractor Feed — A transport system that uses sprocketed wheels (they look like tractor wheels) to continuously move fanfold paper through the printer. The system is usually highly reliable in terms of positional accuracy. A wide variety of paper and labels is available with tractor edgies. In fact, many banks now offer checks in a tractor-feed, or fanfold, format.

Unidirectional Printing — a situation in which the printhead prints only while moving from left to right or (less frequently) from right to left. After printing a line, the head must return to the starting side of the platen before printing the next. This takes longer than bidirectional printing, but allows increased accuracy for graphics and NLQ text. By starting at the same horizontal position on each line, the printer ensures vertical lines are straight. (Vertical lines printed in the bidirectional mode on dot-matrix impact printers often look jagged.) ❑

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the printer to print extra blank lines. You can reset the switch manually for these occasions, or send a control code to temporarily switch the printer to the carriage return-only mode.

If you plan to use a serial printer, make sure the switches that control data transfer speed are set correctly. The default for the CoCo is 600 baud, but you can change this by poking the appropriate value from the following table into Memory Location 150:

Baud	Value
600	87
1200	41
2400	18
4800	7
9600	1

Another aspect of using printers with the CoCo is learning how to tell the printer what you want it to do. Printer manuals are a gold mine of information for the hacker, but from a user's point of view, they rarely supply sufficient information. (I'm putting this rather kindly.) Still, the manuals list the codes necessary to make your printer accomplish great feats.

To send control codes requires nothing more than typing `PRINT#-2,` followed by the necessary codes. For example, to set the DMP-107 to print italics in the Tandy mode, you must send an escape code (ESC) followed by 66 and 1. You would enter

```
PRINT#-2,CHR$(27);CHR$(66);CHR$(
1);
```

The semi-colon at the end of the line is important. This character inhibits the carriage return that would normally be sent, so the paper doesn't advance one line. To turn off italic print, send the same line, but replace 1 with 0. You can also send control codes using hexadecimal numbers. For example, you would initiate italics by entering

```
PRINT#-2,CHR$(&H1B);CHR$(&H42);C
HR$(&H1);
```

To save time, many people use the actual ASCII characters when sending control codes. The ASCII character for decimal 66, as used in the first example, is the uppercase letter B. The line could be entered as

	Downloadable Chars.	Built-in Fonts	Supported Pitches	Printer Emulations	Front-panel Control	Panel Lock
Tandy DMP-107	**N**	**Draft, NLQ**	**10, 12, 17, Prop**	**IBM Graphics Tandy Codes**	**Online/Offline**	**N**
Tandy DMP-134	**Y**	**Draft, NLQ**	**10, 12, 17, Prop**	**IBM Proprinter**	**NLQ, margins, pitch**	**N**
Tandy DMP-240	**Y**	**Draft, Roman, Courier, Sans Serif, Prestige**	**10, 12, 15, 17, 20, Prop**	**IBM Proprinter X24 Epson LQ-2550**	**font, pitch, emulation, color, macros, style, page layout, char. set**	**Y**
Tandy DMP-302	**Y**	**Draft, Roman, Courier, Helvette, Orator, Gothic, Prestige**	**10, 12, 15, 17, 20, Prop**	**IBM Proprinter X24 Epson LQ-850**	**font, pitch, style, page layout, char. set, emulation**	**N**
Panasonic KX-P1124	**Y**	**Draft, Courier, Sans Serif, Prestige, Script, Bold PS**	**10, 12, 15, 17, 20, Prop**	**IBM Proprinter X24 Epson LQ-2500**	**font, pitch, char. set, page layout, macros**	**N**
Panasonic KX-P1180	**Y**	**Draft, Courier, Bold PS, Sans Serif, Prestige**	**10, 12, 15, 17, 20, Prop**	**IBM Proprinter II Epson FX-86e/FX-800**	**font, pitch**	**N**
Star NX-1001	**Y**	**Draft, Courier, Orator, Orator-2, Sanserif**	**10, 12, 17, 20, Prop**	**IBM Proprinter II Epson LX-810**	**font, pitch**	**Y**
Star NX-1020	**Y**	**Draft, Courier, Orator, Sanserif, Script**	**10, 12, 17, 20, Prop**	**IBM Proprinter III Epson FX-850/EX-800**	**font, pitch, emulation, color, macros, page layout, char. set**	**Y**
Star NX-2420	**Y**	**Draft, TMS ROMN, Courier, Sanserif, Prestige, Script**	**10, 12, 15, 17, 20, Prop**	**IBM Proprinter X24E Epson LQ-850**	**font, pitch, emulation, page layout, macros, character set**	**Y**
Citizen 200GX	**Y**	**Draft, Sans Serif, Roman, Courier**	**10, 12, 15, 17, Prop**	**IBM Proprinter III Epson FX-850/EX-800**	**font, pitch**	**Y**
Citizen GSX-140	**Y**	**Draft, Roman, Courier, Sans Serif, Prestige**	**10, 12, 15, 17, Prop**	**IBM Proprinter XL/24 Epson LQ series**	**font, pitch, color page layout, emulation macros, char. set**	**Y**
Seikosha SP-2000	**Y**	**Draft, Serif**	**10, 12, 17, 20, Prop**	**IBM Proprinter II**	**pitch, page layout**	**Y**

Figure 2: Manufacturer's Specifications — Software and Control

Serial and Parallel

Computers form data words from single bits, or Binary digITs. Most personal computers, like the Color Computer, use words that are eight bits in length (a byte). While there are many ways to send computer data (electrons through wires, pulses of light, etc.), there are only two basic forms in which the data can be sent: Serial and parallel.

In serial communications between two electronic devices, each bit making up a word is sent and received sequentially — that is, one bit at a time. A handshaking protocol allows both devices to know how many bits are to be transferred and how fast — they will both be able to determine when each word is complete and when to move to the next.

In parallel data transmission, all bits forming a word (in this case a byte) are sent at the same time. Timing circuitry allows the receiving device to be sure it has all the bits and lets it know when the next word can be expected. Since all bits in a word are transmitted at once, the process is much more efficient.

Parallel interfaces are not, however, without limitations. Cable capacitance effectively limits cable length in most cases. The generally accepted maximum reliable length for a parallel cable is 12 feet. In contrast, serial cables using shielded cable are generally reliable at lengths of 50 feet or more.

The Color Computer comes equipped with a 4-pin serial port that can be used to connect the computer to a printer. Appropriately, Tandy designed the same port into most of its printers (especially those on the low end of the price scale). However, this 4-pin port is not standard and few other manufacturers followed suit. This pretty much limited CoCo users to Tandy printers.

Adventurous CoCo users found they could build special cables on their own, allowing their CoCos to work with the more standard serial ports found on other printers. And this works fine. However, printers using parallel interfaces are far more prevalent, and other methods were needed to allow CoCo users to take advantage of these products. A serial/parallel converter does just that — it accepts serial data in one end and turns it into parallel data on the other.

Currently, three RAINBOW advertisers offer serial/parallel converters: Dayton Associates, Micro-com Software and Supersoft. These devices are easy to install — plug the 4-pin DIN connector into the CoCo and the 36-pin connector into the printer and away you go. You can set the CoCo's sending data transfer rate to 9600 baud (or slower values if you want — but why?) and the printer should easily accept the converted parallel data. This increases your overall printing speed and efficiency. At least one converter (the Blue Streak Ultima from Dayton Associates) currently sold in the CoCo market accepts data at up to 19,200 baud. You can achieve this transmission rate with a CoCo 3 in the high-speed mode set for 9600 baud.

There is one caveat to serial/parallel converters, however: Some printers provide a source of 5 volts on Pin 18 of the 36-pin "Centronics" connector. Others do not; and of those that do, manufacturers often recommend this power source not be used. As most serial/parallel converters are designed to get their power from this source, you may need to use a separate power supply. The advertisers who carry converters will, more than likely, be glad to offer assistance if you're not sure about your printer.

A hidden advantage to using a serial/parallel converter with a parallel printer is the ability to put more distance between the computer and the printer. Since the CoCo is sending a serial signal, you can easily construct a cable to extend the serial line and move the printer to another room. Then use the converter at the printer end — you gain the distance and speed benefits. Of course, you'll have to weigh the advantages and disadvantages of walking to the other room to get your printouts.

The bottom line is this: Serial/parallel converters open the door for CoCo owners to use most parallel printers with their computers. ❏

```
PRINT#-2,CHR$(27);"B";CHR$(1);
```

The problem with this is that it is time-consuming to decipher such control codes when debugging a program.

CoCo word processors don't provide default drivers for the many printers available — you must set up the word processor so that it knows the codes your printer uses. If you want to use your printer to its fullest, you'll have to learn how to implement its control codes. I encourage you to study the manual and learn how to control your printer. Your enjoyment of your system will only increase (or, perhaps you'll find you need to look for a more feature-packed printer).

Buyer's Considerations

It goes without saying, *but* . . . it is very important that you keep an open mind and avoid impulses when considering a new printer. It's going to take some time after you buy a printer to understand all of its intricacies. Return policies vary, but, in general, once you've bought it, it's yours. If you can, visit a local computer store and see the printer in action — even if you plan to buy it from a RAINBOW advertiser (just don't tell the store salesman what you're doing).

Think about how you plan to use your new printer. Which features are absolute necessities and which are luxuries? If you are a programmer on a tight budget, and you need to print program listings only, do you really need NLQ and color capabilities? On the other hand, if you plan to run a business, can you expect to do well without these features?

Avoid compromising your needs and letting your pocketbook be your guide. If you get a printer that doesn't have the features you want or need, you *will be* sorry (not to mention a few hundred bucks poorer when you buy a new unit to meet those needs). It might be better to wait until you can afford the right printer or until the price comes down. Also, look for good deals on a second-hand unit.

A very important question is whether or not the software you plan to use supports the printers you are considering. While most word processors can be made to work well with just about any printer, *Max 10* and *Home Publisher* work only with a limited selection. Contact the makers of the programs you plan to use before making a final decision.

Just as important is whether or not you can purchase software to accomplish your goals. If you want to print color-graphics images, can you buy a program to do this with the printer in question? Does the software come bundled with the printer? Some RAINBOW advertisers include screen-dump software (and even serial/parallel interfaces) with the printers they sell.

Other factors to consider are built-in (or add-on) fonts, paper-feed mechanisms, paper (platen) width, emulations, download characters, and color and NLQ capabilities. And remember that not all features supported by a printer (italics, bold, proportional spacing, etc.) are necessarily available at all pitches or with all fonts.

Use figures 1 and 2 for reference. While we don't have the room to cover all printers, these charts are as complete as space allows, and the printers we mention are fairly representative. With hundreds of different printers on the market, you'll have to do a great deal of the legwork. But the information presented here should give you a good start.

Conclusion

This article has briefly explained several aspects of dot-matrix impact printing, and printers in general. The door is open, though, as each of these aspects deserves a full article in itself. We welcome your suggestions and article submissions, should you decide to follow up on this.

If you need more assistance, your local computer stores and advertisers in THE RAINBOW are excellent sources of information. These sources have certainly been useful to me. In addition, my thanks go to RAINBOW's technical editor, Greg Law, and to William R. Hall of Dayton Associates for the help and information they provided.

The world of printers is sometimes a mysterious one indeed, but it doesn't have to be. Best of luck, and good hunting!

OS-9 Guidance

THE RAINBOW Staff

Where can I find a book that covers writing assembly-language programs for use under OS-9 Level II? I've learned how to use BASIC and assembly language (using EDTASM+*) under Disk BASIC. I also use BASIC09. But I have yet to find any literature to help me get started in the world of assembly with OS-9.*

R.W. Kemper
Hinesville, Georgia

At present, we know of no books oriented toward teaching how to program in assembly language under OS-9. However, programming under OS-9 is nearly the same as programming with *EDTASM+*. An exception is that OS-9 requires you to write position-independent code (PIC). This dictates the use of branch instructions. Also, OS-9 uses no ROM calls. Instead of using a `JSR` instruction to jump to routines in ROM, you will use the OS-9 opcode followed by a system-call number. For example,

```
OS9 I$Read
```

calls the read routine for the device specified in the path number. Currently, the easiest way to learn OS-9 assembly-language programming is to study source code written by others.Also, see the upcoming June issue inwhich we are publishing a detailed article on assembly language for Level II .

I purchased several issues of RAINBOW ON DISK at a RAINBOWfest and I'm trying to back them up. I use the Disk BASIC `BACKUP` *command, and all appears to work normally. But when I do a* `DIR` *on the disk, all I get is a bunch of lines with blocks followed by 229's. Also, I have a CoCo 3 and I read in a back issue of THE RAINBOW about an upgrade that makes OS-9 work on this machine. Can you help?*

Ada Corcoran
Caledonia, New York

You can use `BACKUP` under Disk BASIC to copy OS-9 disks — the disk structures used by OS-9 and Disk BASIC are the same. However, the *directory* structures used by the two systems are different. Disk BASIC uses a contiguous, single-level directory structure that is written on Track 17, Sector 3, of the disk. OS-9 uses a hierarchical directory structure and usually starts its directory entries on Track 0. Therefore, when you enter `DIR` with an OS-9 disk in Drive 0, Disk BASIC gives you the information stored on Track 17, which is usually meaningless. Once you boot OS-9, you can see the actual directory of the RAINBOW ON DISK (or any OS-9 disk) using OS-9's `dir` command.

Tandy at one time offered OS-9 Level I, Version 2.00.00, an upgrade that works on the CoCo 3. This upgrade is no longer available. Since you have a CoCo 3, though, you should seriously consider purchasing OS-9 Level II. Then you'll have access to multiple windows, and you'll be able to take better advantage of the CoCo 3's extra memory.

How can I copy a file from one directory to another on an OS-9 disk?

Keith Burt
Needham, Massachusetts

Let's take a look at the basics. OS-9 uses a hierarchical directory structure. This means an OS-9 disk may contain a number of separate directories, and each of these might contain more directories and files, and so on. Each file on an OS-9 disk has its own associated *pathlist* (also called a *path-name*) that tells the system exactly where to find that file on the disk. A full pathlist includes the name of the device where the file is stored (in this case, a disk drive), the names (in order) of each directory and subdirectory leading to the file, and finally the filename itself. For example, the pathlist to the `free` command on your OS-9 System Master disk is `/d0/CMDS/free`. This means the `free` command is in the `CMDS` directory on the disk mounted in Drive 0. If you move that disk to Drive 1, the full pathlist becomes `/d1/CMDS/free`.

The `copy` command expects you to use the syntax

```
copy pathlist1 pathlist2
```

where *pathlist1* is the full pathlist to the file you want to copy, and *pathlist2* is the full pathlist to where you want to copy the file, as well as what name it should have. To copy the `free` command from the `CMDS` directory on the *backup* copy of your system disk to the `SYS` directory, you would enter

```
copy -s /d0/cmds/free /d0/sys/free
```

The `-s` option tells the `copy` command you want to use a single drive for the operation. (You are prompted to swap the source and destination disks.) With a little practice, using pathlists becomes second nature, and you'll learn shortcuts to using them. We encourage you to study OS-9's tree-like directory structure as well as the `chd` and `chx` commands.

I'm working on learning BASIC09, and I'm transferring some programs previously written in BASIC. I am having some problems trying to arrange an array so I can enter data into it. I have used the same input lines as in the BASIC program, and they work for strings but not for numeric data. I don't understand the error messages. Also, the error messages have numbers before them, but they don't often match any numbers in the program, so I don't know where to look for the error. Can you help?

James E. Parsons
Granite City, Illinois

We admire your desire to learn BASIC09, and rewriting BASIC programs is an excellent way to learn. The listing you sent is shown in Figure 1. The hexadecimal numbers down the left edge are called *offsets*. They are intended as a guide for troubleshooting and commenting, and they represent the number of bytes required by each line in the procedure. These offsets change as you alter a program. Similarly, the number to the left of an error message indicates exactly at which byte in the procedure the error was encountered. This could be in the *middle* of a line, so the offset numbers might not match.

The BASIC09 procedure you sent appears to be a small part of a much larger program and is fairly straightforward. It dimensions several variables, sets the screen and proceeds to check 100 records for a date. If a given record has no date, it is considered empty and the user is prompted to fill the record.

Page A-2 of the BASIC09 section of the Level II manual tells us Error 65 stands for "Wrong number of subscripts." According to the messages, this error first occurs at Offset $017F, which is somewhere between offsets $015D and $0183. A careful look shows that Variable `gross` has been defined as a single-dimension, single-value variable of type `REAL`. It is not defined as an array, so the program has no idea what you want it to do as far as the subscript (`loopcounter`) is concerned. Further, all the other errors occur at similar points for the variables `federal`, `state`, `city` and `social`. These five variables need to be defined as arrays in the `DIM` statements. Once you've done this and have the procedure working, consider using BASIC09's `TYPE` statement to organize the records. This can make disk I/O and record management much simpler and faster.

```
PROCEDURE Income_Input
 0000      BASE 0
 0002      DIM loopcounter:INTEGER
 0009      DIM company(100):STRING[20]
 001A      DIM date(100):STRING[20]
 002B      DIM gross,federal,state:REAL
 003A      DIM city,social:REAL
 0045      PARAM year:INTEGER
 004C      SHELL "display c"
 0059      PRINT year; "          I n c o m e   D a t a   I n p u t"
 008E      PRINT "-------------------------------------------------------
---------------------------"
 00E1      PRINT
 00E3      FOR loopcounter:=0 TO 100
 00F3        EXITIF date(loopcounter)="" THEN
 0102        ENDEXIT
 0106      NEXT loopcounter
 0111      INPUT "Date                    :",date(loopcounter)
 0137      INPUT "Company                 :",company(loopcounter)
 015D      INPUT "Gross                   $",gross(loopcounter)
 0183      INPUT "Federal Taxes           $",federal(loopcounter)
 01A9      INPUT "State                   $",state(loopcounter)
 01CF      INPUT "City                    $",city(loopcounter)
 01F5      INPUT "Social                  $",social(loopcounter)
 021B      PRINT loopcounter
 0220      END
017F ERROR #065
01A5 ERROR #065
01CB ERROR #065
01F1 ERROR #065
0217 ERROR #065
```

Figure 1

After purchasing a copy of the C Compiler, I recently came across a patch I want to pass along. This patch to `c.prep` *tells the C Compiler to look for the* `DEFS` *directory on the default drive (*`/dd`*) rather than on the disk in Drive* `/d1`*. Use the following* `modpatch` *file to complete the patch:*

```
L c.prep
C 135d 31 64
V
```

Can you tell me how to gain access to Level II's graphics capabilities with C? I cannot seem to find the Level II Development System.

John M. Gilbertson
Portsmouth, Virginia

Thanks for the patch to `c.prep`. As for using graphics, you could build your own library. Do this using standard C source and linking the object (`.r`) file with

```
CWArea(path, cpx, cpy, szx, szy)
int path, cpx, cpy, szx, szy;
{
    char buffer[6];

    buffer[0] = '\x1B';
    buffer[1] = '\x25';
    buffer[2] = (char) (cpx & 0x00FF);
    buffer[3] = (char) (cpy & 0x00FF);
    buffer[4] = (char) (szx & 0x00FF);
    buffer[5] = (char) (szy & 0x00FF);
    write(path, buffer, 6);
}
```

Figure 2

```
Bar(path, x, y)
int path, x, y;
{
    char buffer[6];

    buffer[0] = '\x1B';
    buffer[1] = '\x4A';
    buffer[2] = (char) ((x >> 8) & 0x00FF);
    buffer[3] = (char) (x & 0x00FF);
    buffer[4] = (char) ((y >> 8) & 0x00FF);
    buffer[5] = (char) (y & 0x00FF);
    write(path, buffer, 6);
}
```

Figure 3

The Rainbow Bookshelf

The Rainbow Book of Simulations
20 award-winning entries from THE RAINBOW's first Simulations contest.
The Second Rainbow Book of Simulations
The 16 Winners from our second Simulations contest.
The Complete Rainbow Guide to OS-9
Authors Dale Puckett and Peter Dibble demonstrate OS-9's multitasking and multiuser features.
The Complete Rainbow Guide to OS-9 Level II Vol.I: A Beginners Guide to Windows
Puckett and Dibble uncover the mysteries of the new windowing environment.
The First Rainbow Book of Adventures
Contains 14 winning programs from our first Adventure contest.
The Second Rainbow Book of Adventures
Featuring 24 of the most challenging Adventure games ever compiled.
The Third Rainbow Book of Adventures
The Excitement continues with 19 new Adventures.
The Fourth Book of Adventures
Fourteen fascinating new Adventures from the winners of our fourth Adventure competition.
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Dr. Michael Plog and Dr. Norman Stenzel give a solid introduction to the realm of statistical processes.

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☐ Second Rainbow Simulations Disk	$~~10.95~~	$ 4.95	_____
☐ Second Simulations Package with Tape	$~~19.90~~	$ 8.95	_____
☐ Second Simulations Package with Disk	$~~20.90~~	$ 8.95	_____
☐ **The Complete Rainbow Guide to OS-9**	$~~19.95~~	$12.95	_____
☐ Rainbow Guide to OS-9 Disk Set (2 disks)	$~~31.00~~	$19.95	_____
☐ Rainbow Guide to OS-9 Package	$~~47.95~~	$29.95	_____
☐ **The Windows & Applications Disk for** The Complete Rainbow Guide to OS-9 Level II, Vol. I		$19.95	_____
☐ **The Rainbow Book of Adventures** (first)	$ ~~7.95~~	$ 2.00	_____
☐ Rainbow Adventures Tape (first)	$ ~~7.95~~	$ 2.00	_____
☐ First Adventure Package	$~~15.90~~	$ 3.50	_____
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FILL OUT YOUR COCO LIBRARY WITH THESE SELECTIONS

Mail to: Rainbow Bookshelf, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. To order by phone (*credit card orders only*) call (800) 847-0309, 8 a.m. to 5 p.m. EST. For other inquiries call (502) 228-4492.

Please note: The tapes and disks offered by The Rainbow Bookshelf are not stand-alone products. That is, they are intended to be an adjunct and complement to the books. Even if you buy the tape or disk, you will still need the appropriate book for loading and operating instructions. OS-9 is a registered trademark of the Microwave Systems Corporation.

your other programs. The graphics functions listed in the Windows section of the Level II manual are handled by writing a string to a window. For example, the function to handle `DWEnd` might be written

```
DWEnd(path)
int path;
{
    write(path, "\x1b\x24",2);
}
```

Functions that accept arguments are a little trickier. The `CWArea` function accepts the (x,y) coordinates and the size (also as coordinates) as byte values. For easier manipulation, these coordinates should be declared as integers in the program that will be calling the graphics module. They should then be converted to byte values in your `CWArea` module. The function shown in Figure 2 uses an array to store the string temporarily. The code sequence for `CWArea` (1B 25) is stored in the first two elements of this array. Each of the coordinates has its upper byte masked (`cpx & 0x00FF`) so only the lower byte remains. The coordinate is then typecast from an integer to a character (one-byte) variable. Typecasting may not be absolutely necessary, but it helps ensure the compiler doesn't accidentally stuff two bytes into the array.

Drawing commands are even trickier because they use two-byte values for the coordinates. For these functions, you need to convert the coordinates into byte pairs. Look closely at the source code in Figure 3. Notice the technique used to split the x and y coordinates into byte pairs. The upper byte of the integer value is shifted right eight bits. This effectively moves the upper byte to the lower byte. The shifted value is masked with `0xFF`, and the value is cast to a character and copied into an array. The lower byte is handled simply by masking the upper byte, casting the value to a character and assigning this value to the array.

The Level II *Development System* (Cat. #26-3032) is available through Tandy's Express Order system. Call (800) 321-3133. For a more in-depth discussion of using windows and graphics functions via C, see "BreakPoint" on Page 20 of this issue.

Your questions regarding OS-9 are welcome. Please address them to OS-9 Hotline, THE RAINBOW, P.O. Box 385, Prospect, KY 40059.

We reserve the right to publish only questions of general interest and to edit for brevity and clarity. Due to the large volume of mail we receive, we are unable to answer letters individually.

Questions can also be sent to us through the Delphi CoCo SIG. From the CoCo SIG> prompt, pick Rainbow Magazine Services. Then at the RAINBOW> prompt, type ASK (for Ask the Experts) to arrive at the EXPERTS> prompt, where you can select the OS-9 Hotline online form.

How to Read Rainbow

When we use the term CoCo, we refer to an affectionate name first given to the Tandy Color Computer by its many fans, users and owners.

The BASIC program listings printed in THE RAINBOW are formatted for a 32-character screen — so they appear just as they do on your CoCo screen. One easy way to check on the accuracy of your typing is to compare which character in a line appears under which. If the characters match — and your line endings come out the same — you have a pretty good idea that your typing is accurate.

We also have "key boxes" at the start of the listings to show you the *minimum* system a program needs. But, *do* read the text before you start typing.

Finally, the little disk and/or cassette symbols on the table of contents and at the beginning of listings indicate that the program is available through our RAINBOW ON TAPE/DISK service.

Using Machine Language

The easiest way to enter a machine-language program into memory is to use an editor/assembler, a program you can purchase through Tandy's Express Order System. All you have to do, essentially, is copy the relevant instructions from the RAINBOW listing into the CoCo.

Another method of putting an ML listing into the CoCo is called "hand assembly" — assembly by hand, which *sometimes* causes problems with `ORG` and `EQU` statements. You need to understand ML should such problems arise.

Use the following program if you want to hand-assemble ML listings from THE RAINBOW:

The Listing:

```
10 CLEAR200,&H3F00:I=&H3F80
20 PRINT "ADDRESS:";HEX$(I);
30 INPUT "BYTE";B$
40 POKE I,VAL("&H"+B$)
```

This program assumes you have a 16K CoCo. If you have 32K or more, or if you have a CoCo 3, change `&H3F00` in Line 10 to `&H7F00` and change the value of `I` to `&H7F80`.

OS-9 and Rainbow On Disk

The OS-9 side of RAINBOW ON DISK normally contains two directories: `CMDS` and `SOURCE`. It also contains a file, `read.me.first`, which explains the division of the two directories. The `CMDS` directory contains executable programs and the `SOURCE` directory contains ASCII source code for these programs. BASIC09 programs will be offered only in source form so they are found only in the `SOURCE` directory.

OS-9 is a very powerful operating system. For this reason, it is not easy to learn OS-9 at first. However, while we can give specific instructions for using the OS-9 programs published in THE RAINBOW, you will find that the OS-9 programs are of little use unless you are familiar with the operating system. If you haven't "learned" OS-9 or are not comfortable with it, we suggest you read *The Complete Rainbow Guide to OS-9* and/or *The Complete Rainbow Guide to OS-9 Level II*, both by Dale Puckett and Peter Dibble.

The following is not intended as a course in OS-9. It merely states how to get the OS-9 programs from RAINBOW ON DISK to your OS-9 system disk. Use the procedures appropriate for your system. Before doing so, however, boot the OS-9 operating system according to the documentation from Radio Shack.

☞ Type `load dir copy list` and press ENTER.
☞ If you have only one disk drive, remove the OS-9 system disk from Drive 0 and replace it with the OS-9 side of RAINBOW ON DISK. Then type `chd /d0` and press ENTER. If you have two disk drives, leave the system master in Drive 0 and put the OS-9 side of RAINBOW ON DISK in Drive 1. Then type `chd /d1` and press ENTER.
☞ List the `read.me.first` file to the screen by typing `list read.me.first` and pressing ENTER.
☞ Entering `dir` gives you a directory of the OS-9 side of RAINBOW ON DISK. To see what programs are in the `CMDS` directory, enter `dir cmds`. Follow a similar method to see what source files are in the `SOURCE` directory.
☞ When you find a program you want to use, copy it to the `CMDS` directory on your system disk with one of the following commands. For a one-drive system:

```
copy /d0/cmds/filename /d0/cmds/filename -s
```

The system prompts you to alternately place the source disk (RAINBOW ON DISK) or the destination disk (system disk) in Drive 0. For a two-drive system:

```
copy /d1/cmds/filename /d0/cmds/filename
```

Once you have copied the program, execute it from your system master by placing that disk in Drive 0 and entering the name of the file.

To copy a source file, use the above commands but replace `cmds` with `source`.

The Rainbow Seal

The Rainbow Certification Seal is our way of helping you, the consumer. The purpose of the Seal is to certify to you that any product that carries the Seal has actually been seen by us, that it does exist, and that we have a sample copy here at Falsoft.

Manufacturers of products — hardware, software and firmware — are encouraged to submit their products to THE RAINBOW for certification.

The Seal is not a "guarantee of satisfaction." The certification process is different from the review process. You are encouraged to read our reviews to determine whether the product is right for your needs.

There is absolutely no relationship between advertising in THE RAINBOW and the certification process. Certification is open and available to any product to the CoCo. A Seal will be awarded for *any* commercial product, regardless of whether or not the manufacturer or distributor advertises.

We will appreciate knowing of instances of violation of Seal use.

Rainbow Check Plus

The small box accompanying program listings in THE RAINBOW are part of a *checksum* system, which is designed to help you enter RAINBOW program listings accurately.

Rainbow Check PLUS works by counting the values of each character you enter from a program listing. You can then compare the number you get to those printed in THE RAINBOW. On longer programs, some benchmark lines are given. When you reach the end of one of those lines with your typing, simply check to see if the numbers match.

To use *Rainbow Check PLUS*, enter the program and save it for later use, then type `RUN` and press ENTER. Once the program has run, type `NEW` and press ENTER to remove the BASIC loader from memory.

Now, while entering a listing from THE RAINBOW, whenever you press the down-arrow key, the checksum program issues the `#?` prompt asking you for a line number. Enter the last line number entered that also appears in the checksum table shown at the beginning of the listing, and your CoCo gives the checksum based on the length and content of the program in memory up to and including the specified line number. This is to check against the numbers printed in checksum table. If your number is different than shown in the table, check the listing carefully to be sure you entered the correct BASIC program code. For more details on this helpful utility, refer to H. Allen Curtis' article on Page 21 of the February 1984 issue.

Since *Rainbow Check PLUS* counts spaces and punctuation, be sure to enter the listing exactly the way it is published in the magazine.

The Listing: RBOWCHEK

```
10 CLS:X=256*PEEK(35)+118
20 CLEAR25,X-1
30 X=256*PEEK(35)+118
40 FOR Z=X TO X+137
50 READ Y:W=W+Y:PRINT Z,Y;W
60 POKE Z,Y:NEXT
70 IFW=14367THEN80ELSEPRINT"DATA
 ERROR":STOP
80 EXEC X:END
90 DATA 182,1,106,167,140,120,13
4
100 DATA 126,183,1,106,190,1,107
110 DATA 175,140,110,48,140,4,19
1
120 DATA 1,107,57,129,10,38,98
130 DATA 52,22,142,2,221,159,166
140 DATA 134,35,189,162,133,189
145 DATA 176,47,189
150 DATA 183,61,191,1,218,158,25
160 DATA 109,132,39,19,52,16,174
170 DATA 2,188,1,218,39,6,53,16
180 DATA 174,132,32,237,53,16,17
4
190 DATA 132,48,31,191,1,218,79
200 DATA 158,25,230,132,39,23,23
0
210 DATA 132,39,10,48,2,171,128
220 DATA 171,128,230,132,38,250
230 DATA 188,1,218,39,4,48,1,32
240 DATA 233,183,2,222,48,140,14
250 DATA 159,166,166,132,28,254
260 DATA 189,173,198,53,22,126,0
270 DATA 0,135,255,134,40
280 DATA 55,51,52,41,0
```

Barden's Buffer

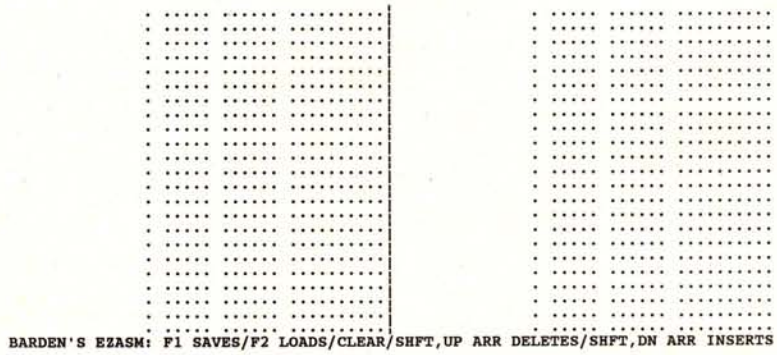
Using *EZASM*

by William Barden, Jr.
Contributing Editor

Last month we provided the listing for *EZASM*, a basic editor/assembler for the CoCo 3. Hopefully you had little problem entering the listing — it *is* a fairly long one. Let's look a little deeper and I'll show you how to use the program for your own assembly-language creations.

The *EZASM* Screen

Figure 1 shows the *EZASM* screen. The screen is divided in half with 23 lines in each half for a total of 46 lines. There is only the one screen. You cannot page back and forth to different screens. You're limited to a total of 46 lines of assembly-language code, which is enough to generate many simple machine-language programs that can be interfaced with BASIC programs or run stand-alone. You can chain together any number of these programs, but each one requires a separate assembly and some manual work to figure out linkage addresses.



BARDEN'S EZASM: F1 SAVES/F2 LOADS/CLEAR/SHFT,UP ARR DELETES/SHFT,DN ARR INSERTS

Figure 1: EZASM Screen Layout

Each of the 46 lines has four parts, or fields, represented by dots on the screen. The first field is one character wide and is an optional label of A through Z for the instruction. Labels allow you to go to a new part of the program. The second field is a five-character field that holds the instruction mnemonic. For example, you'd write `ADDA` for "Add to the contents of the A register." This field must always have a valid instruction mnemonic in it. The third field is a six-character operand field. This field is used for the instruction operand. For example, to add 23 to the contents of the A register, you'd write #23 in the operand field. The operand field is not used for all instructions. Some instructions require no operand at all. `CLRA`, for example, clears the A register and needs no further operand information. The last field is a 10-character comment field that can be used for any special notes, or for nothing at all. A typical assembly language line might look like

```
A ADDA #23  ADD 23 + A
```

But, without a label and a comment, the line would look like

```
  ADDA #23
```

Assembly Errors

One important thing to remember about *EZASM* is that it looks for specific field positions, so don't run things together or you'll get assembly errors. Assembly errors are indicated by an asterisk to the left of the text area. The error indication disappears when you have corrected the error and reassembled the program.

Moving Around the Screen

You can move the cursor around the screen using the up, down, right and left arrow keys. The left and right arrow keys wrap around the screen borders. The up and down arrow keys allow you to move through all 23 lines on the left side of the screen, through all 23 lines on the right, and back again. You can leave blank lines if you want. They are ignored during assembly. You can overwrite characters by moving the cursor with the arrow keys and retyping the character, or the whole line, if necessary. Press CLEAR twice to clear the entire screen and delete any assembly source you've entered. Be very careful when using this feature! Press CLEAR followed by any other key to abort the CLEAR function.

Although blank lines can appear on the

Bill Barden has written 35 books and hundreds of magazine articles about small computers . His newest Color Computer project, Connecting the CoCo to the Real World, *is a book of CoCo interfacing projects. He has over 20 years experience in the industry on systems ranging from mainframes to micros.*

Instructions with no limitations:

`ABX`	Add B to X
`ASLA`	Arithmetic shift left A
`ASLB`	Arithmetic shift left B
`ASRA`	Arithmetic shift right A
`ASRB`	Arithmetic shift right B
`CLRA`	Clear A
`CLRB`	Clear B
`COMA`	Complement A
`COMB`	Complement B
`DAA`	Decimal adjust A
`DECA`	Decrement A
`DECB`	Decrement B
`INCA`	Increment A
`INCB`	Increment B
`LSLA`	Logical shift left A
`LSLB`	Logical shift left B
`LSRA`	Logical shift right A
`LSRB`	Logical shift right B
`MUL`	Multiply
`NEGA`	Negate A
`NEGB`	Negate B
`NOP`	No operation
`ROLA`	Rotate left A
`ROLB`	Rotate left B
`RORA`	Rotate right A
`RORB`	Rotate right B
`RTS`	Return from subroutine
`SEX`	Sign extend
`TSTA`	Test A
`TSTB`	Test B

Instructions with some limitations:

`ADCA`	Add with carry A
`ADCB`	Add with carry B
`ADDA`	Add A
`ADDB`	Add B
`ADDD`	Add D
`ANDA`	And A
`ANDB`	And B
`ANDCC`	And CC
`ASL`	Arithmetic shift left
`ASR`	Arithmetic shift right
`BITA`	Bit test A
`BITB`	Bit test B
`LBCC`	Long branch if carry clear
`LBCS`	Long branch if carry set
`LBEQ`	Long branch if equal
`LBGE`	Long branch if greater or equal
`LBGT`	Long branch if greater
`LBHI`	Long branch if higher
`LBHS`	Long branch if higher or same
`LBLE`	Long branch if less or equal
`LBLO`	Long branch if lower
`LBLS`	Long branch if lower or same
`LBLT`	Long branch is less
`LBMI`	Long branch if minus
`LBNE`	Long branch if negative
`LBPL`	Long branch if plus
`LBRA`	Long branch always
`LBRN`	Long branch never
`LBSR`	Long branch to subroutine
`LBVC`	Long branch if overflow clear
`LBVS`	Long branch if overflow set
`CLR`	Clear
`CMPA`	Compare A
`CMPB`	Compare B
`CMPD`	Compare D
`CMPS`	Compare S
`CMPU`	Compare U
`CMPX`	Compare X
`CMPY`	Compare Y
`COM`	Complement
`DEC`	Decrement
`EORA`	Exclusive or A
`EORB`	Exclusive or B
`INC`	Increment
`JMP`	Jump
`JSR`	Jump to subroutine
`LDA`	Load A
`LDB`	Load B
`LDD`	Load D
`LDS`	Load S
`LDY`	Load Y
`LDU`	Load U
`LDX`	Load X
`LEAS`	Load effective address in S
`LEAU`	Load effective address in U
`LEAX`	Load effective address in X
`LEAY`	Load effective address in Y
`LSL`	Logical shift left
`LSR`	Logical shift right
`NEG`	Negate
`ORCC`	Or CC
`PSHS`	Push S
`PSHU`	Push U
`PULS`	Pull S
`PULU`	Pull U
`ROL`	Rotate left
`ROR`	Rotate right
`SBCA`	Subtract with borrow A
`SBCB`	Subtract with borrow B
`STA`	Store A
`STB`	Store B
`STD`	Store D
`STU`	Store U
`STX`	Store X
`STY`	Store Y
`SUBA`	Subtract A
`SUBB`	Subtract B
`SUBD`	Subtract D
`TST`	Test

Pseudo-operations:

`FCB`	Fix constant byte
`FCC`	Fix constant character
`FDB`	Fix double byte
`ORG`	Originate

Figure 2

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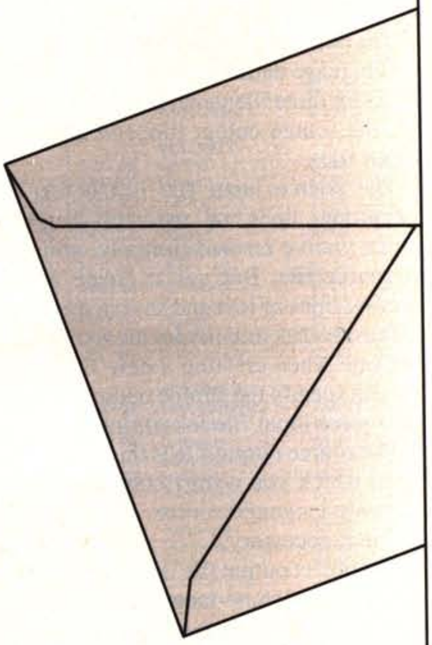

screen, you can delete one by positioning the cursor on it and pressing the SHIFT key, followed by the up arrow key. Create a blank line by pressing the SHIFT key followed by the down arrow key.

Assembling Your Program

Once you've entered the source code (the lines representing the assembly-language program), press F1. This does two things: It assembles the source, and saves the source file as well as the machine-language program on disk.

The source is "assembled" into binary data. This binary data shows up in columns to the left of the lines you've entered. The data is not shown in binary form, but in hexadecimal, a shorthand version of binary. The first column contains four hexadecimal digits representing the location in memory into which the data is placed. If you haven't specified otherwise, these locations start at $7F00, almost to the half way point of the 64K (65,536 bytes) address space. You can change this starting point by using the special `ORG` instruction described later.

The second group of four hexadecimal digits varies in size from two characters to eight characters. Two to eight characters of Hex data represents one to four bytes of binary data. This is the actual data (in hexadecimal) to be placed into memory at the locations specified. You'll see the location column increase as more instructions are assembled, in step with the size of each assembled instruction. This data is the so-called "machine-language" data that is stored in an object file after the assembly process is completed.

The F1 function saves the current assembly-language data. When *EZASM* is first run, it asks for three filenames: The source input file, the source output file, and the object output file.

The source input file is the text file containing lines of assembly-language source you've entered. Initially, you have no source file. But you'll create one by entering lines of text and saving them with F1. Press ENTER initially for the source input filename when creating a new file. Later, you can specify the source output filename as a source input file for editing.

The source output file is the name of the file in which you want *EZASM* to store the assembly-language source. *EZASM* creates the file if necessary.

The object output file is the file in which the actual machine-language program is stored. It is always created when you press F1. This data can be loaded at a later time with a `LOADM` command in Disk BASIC. When you use `LOADM`, the machine-language data is loaded into memory. It is ready to be run as an executable machine-language program — either called by a BASIC program or executed as a stand-alone program.

Reading an Existing File

Press F2 to load a previously entered source file for modification. There is no corresponding object input file since the machine-language program can be easily generated by reassembling the source file. You can assemble your source at any time by pressing F1. Each time you press F1, you see the locations and machine-language data appear to the left of the text lines. You can now go back and change any text as required. After making the first text change, however, you'll see the locations and machine-language data disappear from the screen — although some changes may be innocuous and may not affect the machine-language code, many changes do affect the locations of instructions and actual instruction codes. *EZASM* clears the data to ensure erroneous data is not represented.

Recap of Key Actions

Here is a recap of the *EZASM* keys and their functions:

Up Arrow — moves the cursor up one line at a time.

Down Arrow — moves the cursor down one line at a time.

Left Arrow — moves the cursor one character to the left.

Right Arrow — moves the cursor to the right one character.

CLEAR — clears the screen and the assembled data when pressed *twice*.

SHIFT-Up Arrow — deletes the line at the cursor's current position.

SHIFT-Down Arrow — inserts a blank line at the cursor's position.

F1 — assembles the currently entered source and saves the source output and object output files.

F2 — reads a previously written source input file.

Valid *EZASM* Instructions

EZASM accepts most instructions and addressing modes available on the 6809 microprocessor. I'll explain more about these next month, but a list of instructions and addressing modes is shown in Figure 2.

The limitations for these instructions are as follows:

— Labels must be single characters from A through Z.

— Memory addresses must start with a $ character and be in hexadecimal, or refer to a label. For example, you can add location $7FF0 to the A register by typing `ADDA $7FF0`, or `ADD G` (where `G` is a label at $7FF0).

— Certain indexing-type instructions can be used, but only in the form *+vvv*, *X* or *-vvv*, *X*, where *vvv* is a three-character decimal value and *X* may be Register X, Y, U or S. Leading zeroes must be used (`-001.X`). Auto-increment, auto-decrement, and accumulator offset instructions cannot be used, but the same result can be found by using the *+vvv*, *X* form.

— Indirect addressing cannot be used.

— Direct page addressing cannot be used.

— Relative branches must be of the long-branch type (i.e., `LBCC` instead of `BCC`). Long branches take one more byte, but accomplish the same thing and allow a branch to a location further away.

— The pseudo-ops `FCB` and `FDB` can be used to generate one or two bytes of data. For example, you could have:

`A FCB 12` (constant of 12 decimal)
`B FDB 1000` (constant of 1000 decimal)

— The `FCC` pseudo-op can be used to generate character data. An example is:

```
G FCC Press a Key ##
```

— The `ORG` pseudo-op can be used to define the starting address for the machine-language data, or to redefine it:

`ORG $7E05` (redefine from $7F00)

What are the implications of these simplifications? In fact, they do not affect many programs. Much of the power of assembly language is retained in *EZASM*. I'll show you how to construct simple programs in my next column. In the meantime, try assembling the program in Listing 1. Load and execute it with the BASIC program in Listing 2. The assembly-language program simply clears the 32-column mode screen, but in an instant! You'll be amazed at the speed of this program as compared to BASIC. *EZASM* might increase your interest in assembly language. ❑

Listing 1: `CLRSCN`

```
  LDA   #$20
  LDX   #$400
A STA   +000.X
  LEAX  +001.X
  CMPX  #$600
  LBNE  A
  RTS
```

Listing 2: `CLRSCNDR`

```
100 CLEAR 1000.&H7EFF
110 LOADM "CLRSCN.BIN"
120 EXEC &H7F00
130 PRINT "DONE"
```

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CoCo Consultations

Memory Upgrades

by Marty Goodman
Contributing Editor

Q *How do I upgrade a 16K Extended Color BASIC CoCo 1? It has jumpers that provide settings for 4K, 16K and 32K.*

J. Deane (DEANER)
Kansas City, Kansas

A You apparently have either a D- or E-board CoCo 1. Look on the right side of the board. There should be a series of numbers followed by the letter D or E, or the words Rev D or Rev E. If you have a D board, the upgrade is quite complex and I do not have the space here to describe this process in detail. It involves making trace cuts under the board to reroute power to the RAMs. If the board is an E board, you can upgrade to 32K by moving all three jumpers in the vicinity of the memory chips to the 32K position and moving the jumper near the PIA chip to the 32K position, too. Then cut out all eight capacitors attached to Pin 9 of each DRAM chip. These capacitors are all in a single row near the DRAM chips. Then replace the 4116 chips with 4164 chips. This gives you a 32K Extended BASIC computer. Getting access to the additional 64K is a bit more complex. Details on this type of upgrade can be found in my March 1990 article in THE RAINBOW.

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator — sort of the Howard Cosell of the CoCo world. On Delphi, Marty is the SIGop of RAINBOW's CoCo SIG and database manager of OS-9 Online. His non-computer passions include running, mountaineering and outdoor photography. Marty lives in San Pablo, California.

Returning Control to BASIC

Q *How do I return control of the computer to BASIC after running a machine-language program?*

Ralph McCormic
Keno, Oregon

A If the machine-language program does not disturb the lower area of memory where the BASIC variables reside, and if you saved the stack pointer location and restored it at the end of the machine-language program, (or if you never moved the stack pointer during your machine-language routine) you can return to BASIC with a simple `RTS` (Return from Subroutine) instruction. I use this for all my quick-and-dirty machine-language routines. If you are writing a long and elaborate ML program that stomps all over memory and destroys whatever was in the machine in BASIC before it was executed, you merely need to make the computer do a cold start. On the CoCo 3, this can be done by poking a 0 (zero) into location $71, then jumping to location $8C18 in ROM. On the CoCo 1 and 2, you can jump to $A027 to produce a cold start once you put a 0 in $71.

True Lowercase

Q *How can I use the lowercase capabilities of the last model CoCo 2 (the "CoCo 2B") under OS-9 Level I?*

James Gerrie
Huntsville, Ontario
Canada

A I know of no way to do this. The only way I know to accomplish your goal of true lowercase with OS-9 is to get a CoCo 3. If you drop by Delphi, you can find some good buys on CoCo 3s and OS-9 Level II software in the Classified Ads section.

DeskMate 3 Blues

Q *I am having trouble downloading from Delphi with DeskMate 3. Can you suggest anything?*

George T. Foshee, III (G303FOS545)
Stevenson, Alabama

A There are many better OS-9 terminal programs than the one provided in *DeskMate 3*. I suggest dropping by the OS-9 SIG and asking around there. If you are not an OS-9 user, I suggest looking into *Delphiterm*, a CoCo 3 shareware program by Rick Adams. For $10 he sends you an authorized copy with printed documentation. You can reach Rick via Delphi under the username RICKADAMS. If you want to spend a bit more on a commercial Disk BASIC-based terminal program, the one I use most is *Vterm*. It sells for about $40 and has a nicer display, though *Delphiterm* offers far superior buffer handling in my opinion.

Extended BASIC Upgrades

Q *How do I upgrade a CoCo 2 from BASIC to Extended BASIC?*

Charles Scanlon
Simsbury, Connecticut

A Different models of the CoCo 2 require different upgrade procedures. If your CoCo 2 has two 24-pin ROM sockets, one with a BASIC ROM and the other empty, you need to order the 24-pin Extended BASIC ROM. If your CoCo has a single 28-pin ROM socket that currently houses a 24-pin BASIC ROM chip, you need to order the 28-pin BASIC/Extended BASIC ROM chip. You also need to cut, move, and resolder the five 64K/128K ROM size-select jumpers to the 128K position. I believe Microcom, Howard Medical, Disto, and CoCo Pro! all sell the ROM chips. Specify which chip you need.

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Looking for Amateur Software

Q *What amateur radio software has come out for the CoCo since the 1985 publication of* WEFAX *in THE RAINBOW?*

Donald Wood
West Boylston, Massachusetts

A Since then, I've introduced a Send & Receive version of *WEFAX*, and presented an *RTTY* program for the CoCo that, like the *WEFAX* program, requires almost no hardware interface. The *RTTY* program is available for downloading from Delphi, or write to me in care of THE RAINBOW. For $10 to cover costs, I'll send you a copy of the new *WEFAX* program and the *RTTY* program with 25 pages of documentation and *WEFAX* frequencies to which you can tune. The disk includes a Morse Code Practice program.

Serial Printer Cables

Q *How do I make a cable to hook my Okidata Microline 320 printer's 25-pin serial port to my CoCo 3's 4-pin serial port?*

Sanjiv Patel (HOTCOCO)
Calgary, Alberta
Canada

A The following cable should work in your situation:

4-Pin DIN	**DB-25**
2	20
4	3
3	7

This assumes your printer is set to use Pin 20 (DTR) for hardware-busy handshaking and that it is set so that Pin 20 is low when the printer is busy. Note that some printers have internal DIP switches that allow setting different pins on their 25-pin connectors as the busy-handshake pin and that allow setting the printer to make busy either a high or a low signal. If your printer has such switches (consult the manual), you have to set them as outlined above.

Adding Disk Drives

Q *How can I use an FD-502 Drive 0 as Drive 1 in another FD-502 case?*

Leon Albin
Glen Echo, Maryland

A There are drive-select jumpers on the FD-502 drives. You need to set the drive to act as Drive 1, not Drive 0. This may involve either resoldering jumpers, moving staking pins, or flipping DIP switches on the logic board. You need to trace the lines coming from pins 10 and 12 of the 34-pin connector on the drive. These lines lead to the selection jumpers. Only one of these (either the trace from Pin 10 or the trace from Pin 12) continues into the drive select circuit beyond the jumpers. Pin 10 is for Drive 0, Pin 12 is for Drive 1. This approach can be used to find the drive select jumpers on any unknown floppy drive. I believe the FD-502 did not have a removable terminator resistor, but instead used a soldered-in 1000-ohm terminator. If this is the case, you need not worry about termination. See my article "Disk Drives and the Color Computer" in the March and April 1990 issues of THE RAINBOW for more information.

Genesis to CM-8

Q *How do I hook my CM-8 to a Sega Genesis game machine?*

John W. Hester, Jr.
Selma, Alabama

A Refer to "CoCo Consultations" in the September 1990 issue (Page 54) and November 1990 issue (Page 25).

DC Modem Pak Mods

Q *I'm in the process of modifying a Tandy Direct Connect Modem Pak to turn it into a general purpose RS-232 Pak. I plan to remove the modem, readdress the 6551 chip, and send the serial inputs and outputs of the 6551 through 1488 and 1489 RS-232 voltage-level converter chips, which I will power from the +12 and -12 volts available on my Multi-Pak. My question: Do I need to invert the signals coming out of the 6551 chip before I send them to the level converters?*

Mike Dalene (MDALENE)
Winsted, Connecticut

A No, you can hook appropriate inputs to the 6551 directly to outputs of the 1489 and 6551 outputs to appropriate inputs on the 1488. The signals on the 6551 pins are "active low" or "inverted." The 1488 and 1489 level converters not only convert signal level, but invert the sense of the signal as well. Thus, they go perfectly with the inverted signal levels of the 6551 chip. Note that THE RAINBOW will soon feature an article of mine on how to make such conversions, and CoCo PRO! is already offering kits that I designed to make quick and easy conversions of the DC Modem Pak into a general purpose RS-232 pack.

Merging BASIC ROMs

Q *Can I use a 27256 EPROM (as opposed to a 27C256 EPROM) in the CoCo 3 for experimenting with changes to the BASIC ROM? Or are there problems with too much power drain or incompatibility with signal-driving ability? Can I put both Disk BASIC and CoCo BASIC into a single EPROM in the CoCo 3 to remove the ROM in my controller and reduce overall power drain?*

Doug Pirkey
New Cumberland, Pennsylvania

A As you are apparently well aware, the power supply of the CoCo 3 on the +5-volt line is marginal at best, and the power circuit tends to run quite hot. In fact, the relative reliability of the CoCo 3 as a whole is surprising to me given this bit of marginal-quality design. I cannot be certain whether or not the 50 to 200 mA of extra power drain your NMOS EPROM has over a CMOS EPROM is critical, but it is possible. Given all of this, I suggest you just use a 27C256. The 27C256 costs (brand new, quantity one) only a few dollars and only a dollar or so more than the 27256. I've seen them used at electronic swap meets for a dollar each in tubes of 15. You cannot put both CoCo 3 BASIC and Disk Extended BASIC into the same 27256 EPROM because CoCo BASIC occupies the entire 32K in the CoCo BASIC ROM. It accesses "hidden" parts of itself via bank select capabilities of the GIME chip, as documented in the Tandy Service Manual for the CoCo 3 and in several articles in THE RAINBOW on GIME chip operation (such as "GIME More Power" by Rick Adams).

If you are concerned about too much stress on the power supply, the proper approach is to reengineer the power supply itself. Replacing the little TO-220 power transistor and its whimpy heat sink with a big, fat TO-3 power transistor and a thick, finned heat sink goes a long way toward making that power supply more substantial. Next, you can substitute a Radio Shack or other 18 VCT, 2-Amp transformer for the one that comes with the CoCo 3. Doing these things gets you plenty of extra power reserve. Finally, if you want to fix bugs in CoCo 3 BASIC, it makes far more sense to just buy Art Flexser's *ADOS3*. He has spent years perfecting numerous CoCo 3 bug fixes and significant enhancements, and his product is set up to allow you to burn it into a new Disk EPROM for an exceptional level of compatibility with Disk Extended Color BASIC. *ADOS3 Extended* supports both 40- and 80-track drives mixed together in the same system and a very flexible RAM disk on 512K systems.

Random Seeds

Q *How can I arrange to get really random numbers for a BASIC program? I'm getting the same "random" sequence each time I use the computer.*

Jason Bucata (JBUCATA)
Ferndale, Michigan

A Art Flexser (ARTFLEXSER) offered the following advice on Delphi. Put the statement `X=RND(-TIMER)` at the beginning of your program. This "randomly" seeds the pseudo-random number generator in the CoCo each time you run the program. Be sure that this statement is executed only once at the start of the program and not repeatedly. In its "BASICally Speaking" column, THE RAINBOW gave some wrong advice on that score . . . the column incorrectly advised readers to repeatedly execute the `X=RND(-TIMER)` statement during operation of the program. This results in less-random numbers.

The CoCo-to-CoCo Connection

Q *How do I make a null-modem cable to go between two CoCo 4-pin DIN ports?*

Len Stone (ELM)
Chicago, Illinois

A The easiest approach involves making a cable with the following three wires:

Pin	Pin
2	4
3	3
4	2

If this does not work, you may have to arrange to tie Pin 1 of both CoCo's 4-pin DIN's High to +10 volts, for some CoCo terminal programs will not turn on their "receive" side unless they get a valid High on Pin 1, the Carrier Detect line.

The Serial Messenger

Q *How do I hook my Smith Corona SD 300 typewriter with Messenger Module computer interface to my CoCo 4-pin serial port? The Messenger Module adaptor provides both a 25-pin serial and a 36-pin parallel port.*

C. Burgos
Bayamon, Puerto Rico

A Make the module send serial data to the 25-pin port. Then, carefully check the information you have on it. Set the module to use hardware handshaking in the form of a busy signal on Pin 20 with a High on that pin to mean Not Busy and Low on that pin to mean Busy. Having done this, make up the following cable:

CoCo 4-pin DIN	Messenger DB-25
4	3
3	7
2	20

All other pins are unused.

Set the Messenger Module's speed to the same speed you are using on your CoCo 3. The CoCo 3 boots in BASIC at 600 baud for its serial port, but you can change this by poking value into Location 150. For example, `POKE 150,1` gives you 9600 baud under BASIC if your CoCo 3 is running at 1 MHz, or 19,200 baud if your CoCo 3 is running at 2 MHz. You should now be able to use the typewriter as a printer.

Your technical questions are welcomed. Please address them to CoCo Consultations, THE RAINBOW, P. O. Box 385, Prospect, KY 40059.

We reserve the right to publish only questions of general interest and to edit for brevity and clarity. Due to the large volume of mail we receive, we are unable to answer letters individually.

Questions can also be sent to Marty through the Delphi CoCo SIG. From the CoCo SIG> prompt, pick Rainbow Magazine Services. Then at the RAINBOW> prompt, type ASK (for Ask the Experts) to arrive at the EXPERTS> prompt, where you can select the "CoCo Consultations" online form, which has complete instructions.

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Turn of the Screw

Multiple A-to-D Input

by Tony DiStefano
Contributing Editor

Recently we looked at how to make your computer record temperatures by reading analog voltages from a temperature-sensor device. The device we looked at is the LM34 temperature sensor. The way we built the circuit, though, only one device can be connected to the analog-to-digital converter we used. To avoid the limitations of that configuration, I dug into my library of data books in search of a solution. This month I'll show you how to connect as many as eight analog devices to that A-to-D converter.

Several years ago a set of digital logic chips called the CD4000 series was introduced. The CD4000 series was one of the first families of devices to use CMOS (Complementary Metal Oxide Semiconductor) technology. This technology allows for very low power requirements, and battery operation of circuits using CMOS-based devices became possible. Also, the voltage requirements are a little more relaxed. These parts work well with up to 18 volts DC. I have built many projects using square 9-volt batteries. The only problem with CMOS parts is that they are very sensitive to static electricity — touch the IC after a short walk across dry carpet and you might as well throw the chip away.

Apart from the static problem, CMOS devices (and specifically the CD4000 series) are quite reliable. There are hundreds of parts in this series: ORs, ANDs, NORs, NANDs, and a whole complement of flip-flops. Among all these digital logic gates, there are also some interesting analog parts. One is the analog multiplexer/demultiplexer.

What is an analog multiplexer/demultiplexer? Let's define the terms and find out. The term *analog* implies a signal that changes smoothly from one value to another. (As opposed to a *digital* signal, which changes in discrete steps.) Audio speakers and amplifiers are good examples of analog devices. *Multiplexer* and *demultiplexer* tell us the signals can be multiplexed (many combined into one) or demultiplexed (one broken down into many). An analog multiplexer/demultiplexer is nothing more than an electronic switch. In the CD4000 series, this device is available in three different configurations: The CD4051, the CD4052 and the CD4053.

The pinout for the CD4051 is shown in Figure 1A. This device is a single, eight-channel switch. It works much like an SP8T (single-pole, 8-throw) switch, but instead of turning a physical knob, you select which of the eight pins is connected to the common pin. Unlike a digital multiplexer or demultiplexer, this device is completely bidirectional — as with a mechanical switch, any pin can be used as either an input or an output.

On a mechanical switch, the position of the shaft determines which pole is connected. With an electronic switch there is no shaft. Instead, the device is switched digitally. Remember binary counting? (Hmm . . . this subject keeps creeping up every time I write about electronics.) I hope you have mastered this topic by now. If not, get a copy of my book, *A Full Turn of the Screw*, and check your back issues of THE RAINBOW.

To count to eight using the binary number system requires three bits. These are

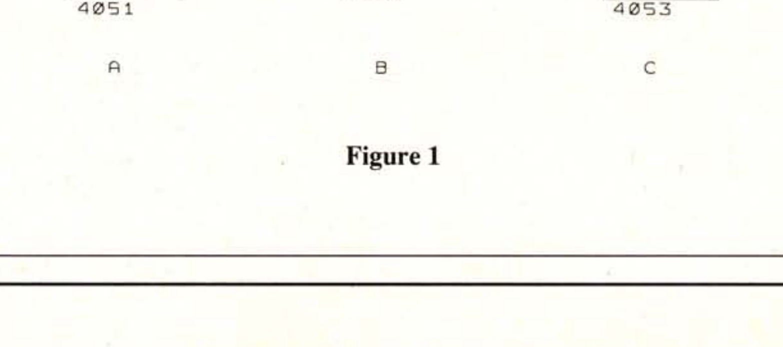


Figure 1

Tony DiStefano is a well-known early specialist in computer hardware projects. He lives in Laval Ouest, Quebec. Tony's username on Delphi is DISTO.

referred to as A, B and C in Figure 1. The digital value of these bits determines which of the eight signals (0 through 7) is connected to the common pin. There is also an Inhibit pin (INH) on the CD4051, which is a digital control signal. When the digital signal to the INH input is High (or a logic 1), there is no electronic connection to any of the signals — all pins are in the high-impedance mode. This works just like the center-off position on many mechanical switches.

The second variation of the analog multiplexer/demultiplexer is the CD4052. The pinout for this part is shown in Figure 1B. The CD4052 has the same characteristics as the CD4051 except it is a dual, four-channel device and has two commons. Each common can be selected from one of four pins. (It's like a stereo in which each side has four signals.) Both commons are controlled using common selector signals. Since there are only four signals to choose from, only two binary bits are needed to do the job (A and B). Again, the Inhibit pin works for both sections of the device at the same time.

The third configuration is the CD4053, as shown in Figure 1C. It, too, is similar to the CD4051, but is a triple, two-channel switch. It has three commons, but each has only two signals. Another difference is that each of the three commons can be controlled individually. The A input controls the first set of signals (X0 and X1), the B input controls the Y0 and Y1 signals, and the C input controls Z0 and Z1. As before, the Inhibit input sets all three commons into the tri-state mode.

The CD4000 series was designed early in the history of digital chips, and since that time more series have been introduced. For example, the 74HC series is also designed to use CMOS technology. In fact, HC is an acronym for *high-speed CMOS*. The HC series is, as far as options go, the most complete series available. In addition, the HC series includes a complete subset of the CD4000 series. It is called the 74HC4000 series and, you guessed it, the 74HC4051, 74HC4052 and 74HC4053 are pin-for-pin replacements for the CD4051, CD4052 and CD4053, respectively. When you are out getting these parts, you can choose either part number.

Now, let's put this theory into use. What we have is one analog-to-digital converter at the computer end, and what we want is the possibility of using many LM34s with this converter. The best device to use in this case is the first, the CD4051, which has eight inputs and a single common. This allows for connection of up to eight LM34s to our circuit. "Why eight temperature sensors?" you may ask. Well, you might use one to measure outside temperature, one for the basement, one for the bedroom, one for the dining room, etc. If you want, you can even have one inside your refrigerator to make sure it doesn't get too hot in there. As you can see, the possibilities are endless.

The circuit required to control and support the analog switch is shown in Figure 2. U4 decodes the proper address for the switch. This 74LS138 chip is a three-to-eight decoder with three enables. The first enable is connected to the E clock of the CPU. This is necessary since the E clock is the qualifier for any Read or Write operation. The other two enable pins are connected together because only one enable signal is needed. The signal labeled NOTE 1 comes from Pin 9 of the 74HC133 used in the previously built analog-to-digital converter. On the Select side, the circuit uses only the A0 address line. If you study the previous circuit, you'll notice A0 is not used. Using A0 causes a memory map mirror. The mirror is at memory addresses $FFA8 and $FFA9. Decoding A0 with the 74LS138 gives two select lines and removes this mirror. The other two select lines, B and C, are not needed in this case and are connected to Ground. This causes output only on Y0 and Y1. When A0 is Low, Y0 is selected. Y0 is connected to the label NOTE 2. Connect this to the wire left hanging after disconnecting Pin 9 of U1 in the original circuit. In effect what we are doing with U4 is removing the mirror and creating a second signal. The A-to-D converter is now memory-mapped only at $FFA8 and not at $FFA9.

The second signal, Y1, is connected to the CLK input of U5,which is a six-bit, D-type latch. The memory location for this latch is $FFA9. The six inputs for this chip come from the data bus (data lines D0 through D5). Though the circuit uses only three bits, I connected the other three bits to allow for future expansion. The CLR pin of U5 is connected to the CoCo's Reset line. This clears all the bits to Low when you press Reset. The three used outputs of U5 drive the three Select bits of the analog switch. As wired, the Inhibit pin is always enabled. The eight inputs of U6 can be any analog input, but in this case use the output

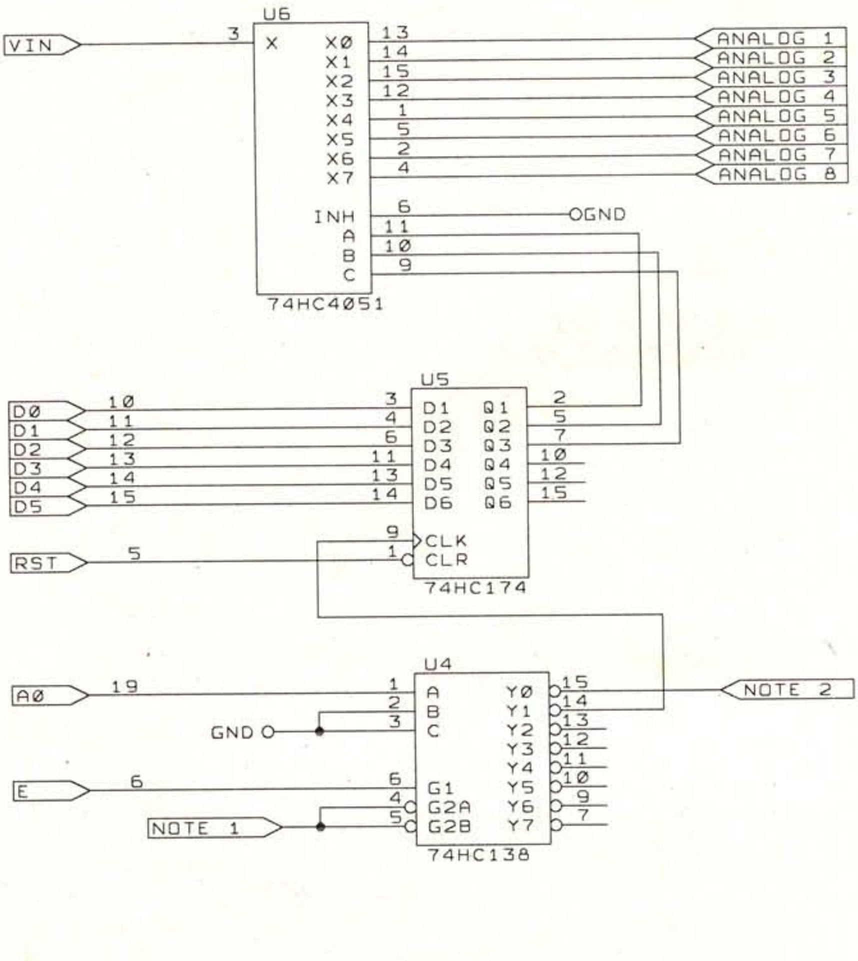


Figure 2

Submitting Material To Rainbow

Contributions to THE RAINBOW are welcome from everyone. We like to run a variety of programs that are useful, helpful and fun for other CoCo owners.

WHAT TO WRITE: We are interested in what you want to tell our readers. We accept for consideration anything that is well-written and has a practical application for the Tandy Color Computer. If it interests you, it will probably interest lots of others. However, we vastly prefer articles with accompanying programs that can be entered and run. The more unique the idea, the more the appeal. We have a continuing need for short articles with short listings. These are especially appealing to our many beginners.

FORMAT: Program submissions must be on tape or disk, and it is best to make several saves, at least one of them in ASCII format. We're sorry, but we do not have time to key in programs and debug our typing errors. All programs should be supported by some editorial commentary explaining how the program works. We also prefer that editorial copy be included in ASCII format on the tape or disk, using any of the word processors currently available for the Color Computer. Also, please include a double-spaced printout of your editorial material and program listing. Do not send text in all capital letters; use upper- and lowercase.

COMPENSATION: We do pay for submissions, based on a number of criteria. Those wishing remuneration should *so state* when making submissions.

For the benefit of those wanting more detailed information on making submissions, please send a self-addressed, stamped envelope (SASE) to: Submission Guidelines, THE RAINBOW, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. We will send you comprehensive guidelines.

Please do not submit material currently submitted to another publication.

of the LM34s as described in my last column. The Common pin (X) of U6 connects to where the single LM34 was connected in the previous part.

This month I'll show you how to connect as many as eight analog devices to the A-to-D converter.

Construction and Testing

Construction of this project is not difficult. Just add three more sockets on the already existing board and wire the circuit. Be sure to remove the other chips before attacking the board with a soldering iron. Make sure not to cause static discharges with all these CMOS parts. Watch for the modifications made to the old part of the circuit. Remember to add a .1-µF capacitor from +5 volts to Ground for each new chip. As usual, not labeled in the diagram are the power connections to the chips. The power pins for the three new chips are

Part #	+5 Volts	GND
74HC4051	16 & 7	8
74HC174	16	8
74HC138	16	8

To make the board completely removable, I suggest you use connectors for all the LM34s. When you are finished, check your wiring. Plug in the board with the chips removed to see if the computer still works. If not, check your wiring for shorts. Next, turn off the power and insert all the chips.

If all is well, turn the power on and start the testing procedure. The best tool for the following test is a digital probe. Start by checking Pin 15 of U4. It should be High and not pulsing. While monitoring the same pin, enter the following command:

```
POKE &HFFA8,0
```

Pin 15 should pulse once. If not, check your wiring. If so, put the probe on Pin 14. It, too, should be High and not pulsing. Enter the following command:

```
POKE &HFFA9,0
```

Pin 14 should pulse once. If not, again check your wiring. If so, check to be sure Q1, Q2, and Q3 of U5 are Low. Then enter

```
POKE &HFFA9,7
```

The Q outputs should now be High. If so, most of the circuit is working. To see if the 4051 is working takes a little more time. Address $FFA9 is the switch location. Poking a number from 0 through 7 into this location selects inputs X0-X7, respectively. Start with 0 and make sure the voltage at X0 matches that at X. Vary the input voltage and check again. Do this seven more times, once for each analog input. If inputs X0-X7 work, the circuit is complete.

Putting the System to Work

Using the circuit is simple. Simply select the analog sensor you want to monitor by poking a number from 0 through 7 into location $FFA9. Once you have selected an input, follow the same procedure as described last time. Remember, however, with the original circuit you could use either $FFA8 or $FFA9. Now you can use only $FFA8. The other address is now used to select which input is to be used.

For those of you with more experience and who require more than eight inputs, consider the following modification: Instead of connecting INH directly to Ground, you could connect it to Q4. Then when Q4 was Low, U6 would be active. When Q4 was High, U6 would be disabled. You could then wire in another 74HC4051. The connections for A, B, C, and X (and +5V and GND) would be connected to the same places as for U6. The INH pin would be connected to Q5 of U5. X0 through X7 would be eight more inputs. Because INH puts the X pin in the high-impedance mode, you would select one 4051 or the other by ORing 8 or 16 with the control byte. Make sure you don't select both at the same time, or you'll get a confusing reading. Using Q6 in a similar manner would allow you to add yet another 74HC4051 to the circuit, thus increasing the number of inputs to 24.

The techniques and principles we've covered are useful in a wide range of applications. Experiment and learn new ways to take advantage of the system. The possibilities are there.

View and print text files quickly with the CoCo 3

Doc Reader

by Stuart T. Wyss-Gallifent

When reading messages on various BBSs and information services, I often simply download all my mail into the terminal buffer and save it to disk for later reading. The problem is how to read the downloaded information — I could load the terminal program again and put the file back into the buffer, but there are limitations. I wrote *Doc Reader* after seeing an MS-DOS program called *See*, which allows users to load a text file, read it and search for strings, and print selected portions. You can use *Doc Reader* on any disk-based CoCo 3 to view and print most any text file.

Enter the program as shown, and save it to disk as `READDOC.BAS`. To execute *Doc Reader*, simply type `RUN"READDOC"` and press ENTER. The screen switches to 80 columns and a summary of available commands is displayed. (To get a printout of *Doc Reader*'s commands, put your printer online at 2400 baud and press P.) The command line appears across the bottom of the screen when you are viewing files. In the left corner is the name of the current active file, the current line number, and a list of functions. This menu bar is displayed at all times, except when the program prompts you for input, in which case the input line replaces the bar.

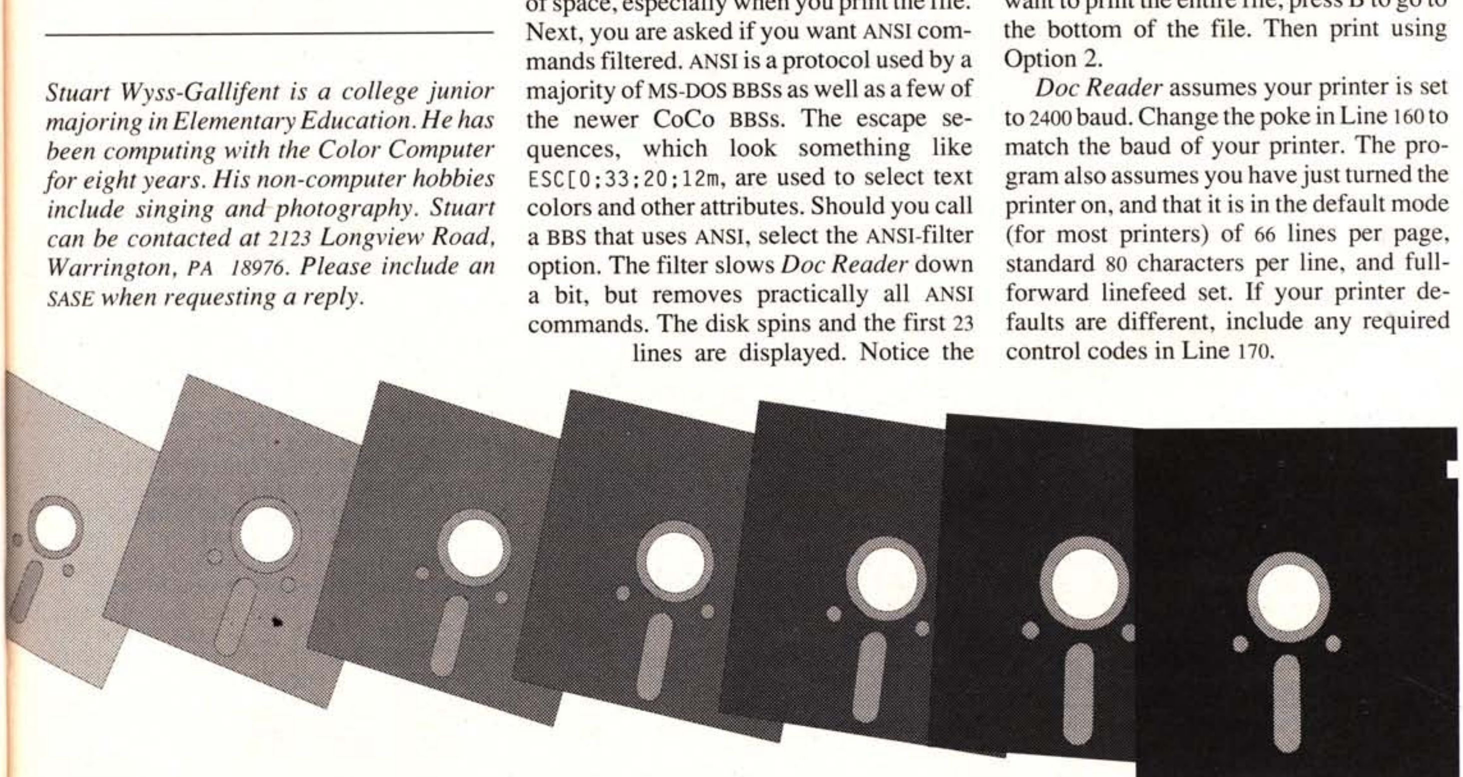
Stuart Wyss-Gallifent is a college junior majoring in Elementary Education. He has been computing with the Color Computer for eight years. His non-computer hobbies include singing and photography. Stuart can be contacted at 2123 Longview Road, Warrington, PA 18976. Please include an SASE when requesting a reply.

To load a file press L. The screen clears and a directory appears. You are then prompted to enter the filename. *Doc Reader* reads any file, as long as it is in ASCII format. This includes `.TXT`, `.ASC` and `.DOC` files, or BASIC programs saved in ASCII (add `,A` to the end of the `SAVE` command when saving the BASIC program). If the filename you enter is not found on the current disk, the directory appears again. If the filename is valid, the program asks whether or not you want blank lines printed. To answer No, press ENTER and any blank lines in the file are omitted as it is read. This can save a lot of space, especially when you print the file. Next, you are asked if you want ANSI commands filtered. ANSI is a protocol used by a majority of MS-DOS BBSs as well as a few of the newer CoCo BBSs. The escape sequences, which look something like `ESC[0;33;20;12m`, are used to select text colors and other attributes. Should you call a BBS that uses ANSI, select the ANSI-filter option. The filter slows *Doc Reader* down a bit, but removes practically all ANSI commands. The disk spins and the first 23 lines are displayed. Notice the filename and the current line number in the left corner of the menu bar.

Movement through a text file is fairly straight-forward. Press the down arrow to display the next line; hold it down to continuously display lines. Press N to load the next 23 lines (basically a page). Press S to search for a text string within the file. You are prompted for the desired string. The program searches for the specified string from the current line to the end of the file. If it is found, the line in which it appears is printed on the screen and the menu bar reappears. Press T to return to the beginning of the file, or B to go to the end. Press E to exit *Doc Reader*.

Press P to print the file; you have two printing choices. Use Option 1 to print the page currently displayed on the screen. Use Option 2 to print all text from the beginning of the file up to and including the page currently displayed. The program tells you how many pages will be printed. If you want to print the entire file, press B to go to the bottom of the file. Then print using Option 2.

Doc Reader assumes your printer is set to 2400 baud. Change the poke in Line 160 to match the baud of your printer. The program also assumes you have just turned the printer on, and that it is in the default mode (for most printers) of 66 lines per page, standard 80 characters per line, and full-forward linefeed set. If your printer defaults are different, include any required control codes in Line 170.



Press BREAK at any time during program operation to return to the menu bar. If an error of any kind is encountered during operation, the program automatically returns to the menu bar. This includes all I/O errors involving the disk drive. There are only two types of disk errors you are likely to encounter: Incorrect spelling of a filename (resulting in an NE error) and an input past end of file (IE error). An IE error is generated at the end of every terminal buffer file because an End-Of-File marker is not included with the saved buffer.

The program is 123 lines long and requires a 128K CoCo 3 and a disk drive. The speed-up poke is used in a few places in the program, but only in areas where no input/output is being done. This should not cause any problems on the CoCo 3.

I saved the program on the same disk as the terminal program I use (*Ultimaterm*) so I can exit from the latter and boot *Doc Reader* without changing disks. I save all my message buffers on the same disk so

CoCo 3 Disk

40	45
90	16
160	209
250	100
330	104
430	112
550	154
630	124
710	134
780	192
890	0
990	151
1100	28
END	122

The Listing: READDOC

```
1 'READDOC
2 'WRITTEN BY STUART WYSS-GALLIF
ENT
3 'COPYRIGHT (C) MAY 1991
4 'BY FALSOFT, INC.
5 'RAINBOW MAGAZINE
10 WIDTH 80:RGB:ATTR 1,0:PALETTE
 0,0:PALETTE 9,63:CLS
20 LOCATE 28,1:ATTR 1,0:PRINT" *
  READDOC  v 1.1  *";
30 LOCATE 22,2:ATTR 5,0:PRINT"
      ASCII  file reader        "
;
40 LOCATE 16,3:PRINT"  by Stuart
 T. Wyss-Gallifent  (June 20,199
0) ";
50 LOCATE 16,5:ATTR 7,0:PRINT"He
re is a brief summary of availab
le commands:":LOCATE 16,6:PRINT
STRING$(46,"-");
60 FOR HE=1 TO 8:READ HE$:LOCATE
 4,2*HE+5:ATTR 1,0:PRINT LEFT$(H
E$,12);:ATTR 7,0:PRINTRIGHT$(HE$
,LEN(HE$)-12);:NEXT HE
70 LOCATE 15,22:ATTR 5,0:PRINT"P
ress P now to dump this summary
to your printer"
80 DATA L  =  load  -gives a dir
ectory and asks for a filename t
o load
90 DATA down arrow  -displays ne
xt line.  Hold for continuous di
splay
100 DATA N  =  next  -displays t
he next page (23 lines)
110 DATA S  =  search-asks for a
nd searches for the first occure
nce of a string
120 DATA P  =  print -either pri
nt the current screen or up to t
he current screen
130 DATA T  =  top   -jumps back
 the the beginning of the file
140 DATA B  =  bottom-displays e
ntire file without stopping
150 DATA E  =  exit  -exits the
program
160 POKE 150,18:' PRINTER BAUD P
OKE    SET TO 2400
170 ' PLACE ANY NECESSARY CONTRO
L CODES FOR YOUR PRINTER HERE (P
ROGRAM ASSUMES 80 CHARS/LINE AND
 66 LINES/PAGE
180 CLEAR 5000
190 ON BRK GOTO 300:ON ERR GOTO
300
200 ' INITIALIZE MENU BAR AND BL
ANK BAR
210 Q$=STRING$(34,32)+"Load down
 Next Search Print Top Bottom Ex
it":MID$(Q$,15,6)="line:"
220 R$=STRING$(78,32)
230 POKE 282,0:' LOWERCASE ON
240 LN=0:GOTO 310
250 ' PRINT BLANK
260 POKE 65497,0:LOCATE 1,23:ATT
R 1,2:PRINT R$;:ATTR 1,0:POKE 65
496,0:RETURN
270 ' PRINT MENU
280 POKE 65497,0:IF VAL(MID$(Q$,
20,5))<>LN THEN MID$(Q$,20,5)="
    ":MID$(Q$,20,LEN(STR$(LN)))=
STR$(LN)
290 LOCATE 1,23:ATTR 1,2:PRINT Q
$;:ATTR 1,0:POKE 65496,0:RETURN
300 '
310 I$=INKEY$:CF=0
320 IF LPEEK(446202)<>116 THEN G
OSUB 270
330 IF I$<>"" THEN IF ASC(I$)>96
 THEN I$=CHR$(ASC(I$)-32)
340 IF I$="E" THEN GOSUB 1190
350 IF I$="L" THEN GOSUB 680
360 IF I$="P" THEN GOSUB 920
370 IF NA$="" THEN 310
380 IF I$="S" THEN GOSUB 820
390 IF I$<>"N" THEN 410 ELSE LOC
ATE 1,23:PRINT STRING$(78,32);:H
=0
400 GOSUB 450:H=H+1:IF H<23 THEN
 400
410 IF I$="T" THEN GOSUB 1150
420 IF I$="B" THEN GOSUB 450:GOT
O 420
430 IF PEEK(342)=247 THEN LOCATE
 1,23:PRINT STRING$(78,32);:GOSU
B 450
440 GOTO 310
450 ' LOAD A LINE
460 IF EOF(1)=-1 THEN 1170
470 LINEINPUT #1,A$
480 IF AN$="n" THEN 630
490 ' FILTER ANSI
500 POKE 65497,0:B=1:F2=0
510 IF B<1 THEN B=1
520 IF CF=1 AND INSTR(1,A$,LEFT$
(ST$,1))=0 THEN A$=CHR$(32)
530 L1=INSTR(B,A$,CHR$(91)):IF L
1=0 THEN 630 ELSE L0=L1
540 IF L1+1>LEN(A$) THEN L3=109:
GOTO 580
550 L2=ASC(MID$(A$,L1+1,1)):IF L
2<47 OR L2>57 THEN B=L1+1:GOTO 5
30
560 IF L1+2>LEN(A$) THEN L3=109:
GOTO 580
570 L3=ASC(MID$(A$,L1+2,1))
580 IF L3=109 OR L3=72 OR L3=65
OR L3=66 OR L3=67 OR L3=68 OR L3
=74 THEN A$=LEFT$(A$,L0-1)+MID$(
A$,L1+3,255):B=L0-1:GOTO 510
590 IF F2=1 THEN L1=L1+1:GOTO 56
0
600 IF L3>46 AND L3<58 THEN L1=L
1+1:F2=1:GOTO 560
610 IF L3<>59 THEN B=L1+3:GOTO 5
30
620 L1=L1+1:F2=1:GOTO 560
630 POKE 65496,0:IF CF=1 THEN RE
TURN ELSE IF YN$="n" THEN IF LEN
(A$)=0 THEN 460
640 IF LEN(A$)>79 THEN LN=LN+INT
(LEN(A$)/80):H=H+INT(LEN(A$)/80)
650 LN=LN+1:MID$(Q$,20,5)="
":MID$(Q$,20,LEN(STR$(LN)))=STR$
(LN)
660 LOCATE 0,23:PRINT A$
670 RETURN
680 ' LOAD
690 CLOSE #1
700 CLS:PRINT"Filename Ext  Attr
":PRINT"------------------":DIR:
POKE 282,255
710 GOSUB 250:LOCATE 1,23:ATTR 1
,2:INPUT"Enter name of file and
extention to view";NA$:ATTR 1,0:
YN$=""
720 POKE 282,0:CLS
730 IF LEN(NA$)>12 THEN 700
740 IF INSTR(1,NA$,".")=0 AND IN
STR(1,NA$,"/")=0 THEN 700
750 MID$(Q$,2,12)=NA$+STRING$(12
-LEN(NA$),32)
760 LN=0:OPEN"I",#1,NA$:IF YN$<>
"" THEN 790
770 GOSUB 250:LOCATE 0,23:ATTR 1
,2:INPUT" Print blank lines (y/N
)";YN$:ATTR 1,0:CLS:IF YN$<>"y"
AND YN$<>"n" THEN YN$="n"
780 GOSUB 250:LOCATE 0,23:ATTR 1
,2:INPUT" Filter ANSI commands (
y/N)";AN$:ATTR 1,0:CLS:IF AN$<>"
y" AND AN$<>"n" THEN AN$="n"
790 H=0
800 GOSUB 450:H=H+1:IF H<23 THEN
 800
810 RETURN
820 ' SEARCH
830 GOSUB 250:LOCATE 0,23:ATTR 1
,2:PRINT" String (ENTER='";ST$;"
') ";:LINEINPUT SP$:IF SP$<>"" T
```

they can be easily read. The biggest advantage of *Doc Reader* is when replying to messages from other users on a BBS. To cut down on phone time, simply toggle the terminal buffer On, "quick-read" all your mail or other messages, and log off. Then save the buffer to disk, exit the terminal program, and boot *Doc Reader*. Now sit back and read the mail at your leisure. Should a message require a response, dump the page to the printer. When you next call the BBS, you can be prepared to answer the questions quickly. You also have a permanent copy of important questions. If you want a list of files offered by a BBS, simply switch on the buffer, have the BBS list all the files, log off and print. Voila! — a hard copy of all the files, spaced to fit the page.

Keep in mind, while my main use of *Doc Reader* is for BBS messages, it can be used to view and print most any text file saved to disk. If you have any questions about *Doc Reader*, please write to me. ❑

```
HEN ST$=SP$
840 ATTR 1,0:CLS
850 IF EOF(1)=-1 THEN 1170
860 CF=1:GOSUB 470:CF=0
870 LN=LN+1:IF LEN(A$)>80 THEN L
N=LN+INT(LEN(A$)/80)
880 GOSUB 270
890 IF INSTR(1,A$,ST$)=0 THEN 85
0 ELSE ATTR 1,0:LOCATE 0,23:PRIN
T A$:H=0
900 GOSUB 450:H=H+1:IF H<21 THEN
 900
910 RETURN
920 ' PRINT
930 LOCATE 0,23:ATTR 1,2:PRINT"
1) this page only  2) up to this
 page  "+STRING$(39,32);:LOCATE
65,23:PRINT"PAGES:"STR$(INT(LN/6
0+.99999));:ATTR 1,0
940 J$=INKEY$:IF J$="" THEN 940
950 ON VAL(J$) GOTO 970,1040
960 RETURN
970 ' PRINT THIS PAGE: SCANS MEM
ORY AND DUMPS TO PRINTER
980 K2=0:POKE 65497,0
990 J=442368
1000 PP=LPEEK(J):IF PP<32 OR PP>
126 THEN PP=32
1010 PP$=PP$+CHR$(PP):K2=K2+1:IF
 K2=80 THEN POKE 65496,0:PRINT #
-2,PP$:PP$="":K2=0:POKE 65497,0
1020 J=J+2:IF J<446048 THEN 1000
1030 POKE 65496,0:RETURN
1040 ' PRINT UP TO THIS PAGE
1050 UT=LN:CLOSE #1:L2=0:L3=0
1060 OPEN"I",#1,NA$
1070 IF EOF(1)=-1 THEN 1170
1080 CF=1:GOSUB 470:CF=0
1090 IF YN$="n" THEN IF LEN(A$)=
0 THEN 1080
1100 L2=L2+1:L3=L3+1:IF LEN(A$)>
80 THEN L2=L2+INT(LEN(A$)/80):L3
=L3+INT(LEN(A$)/80)
1110 IF L2>UT THEN RETURN
1120 PRINT #-2,A$
1130 IF L3=>60 THEN PRINT #-2,ST
RING$(66-L3,13);:L3=0
1140 GOTO 1070
1150 ' TOP
1160 CLS:CLOSE:GOSUB 760:RETURN
1170 ' EOF
1180 LOCATE 0,23:ATTR 1,2:PRINT"
                ----END OF FILE
--- press any key to continue
               ";:CLOSE #1:ATTR
1,0:EXEC 44539:GOTO 310
1190 ' END
1200 GOSUB 250:LOCATE 0,23:ATTR
1,2:PRINT" Are you sure (y/n) ?"
;:ATTR 1,0
1210 J$=INKEY$:IF J$="" THEN 121
0 ELSE IF J$<>"y" THEN RETURN
1220 CLOSE:POKE 282,255:POKE 113
,0:EXEC 40999
1230 ' END OF PROGRAM
```

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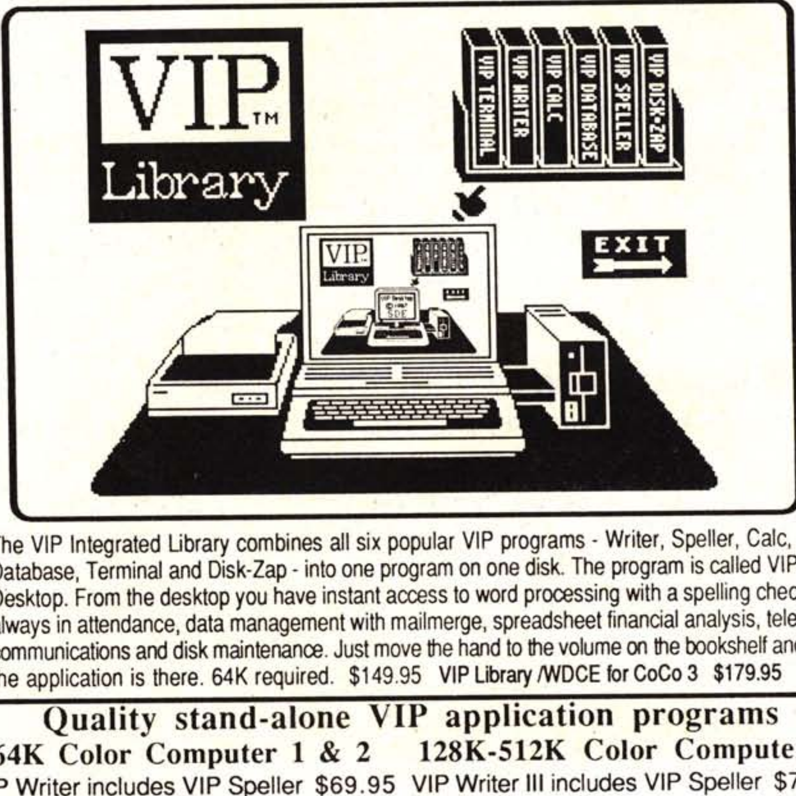

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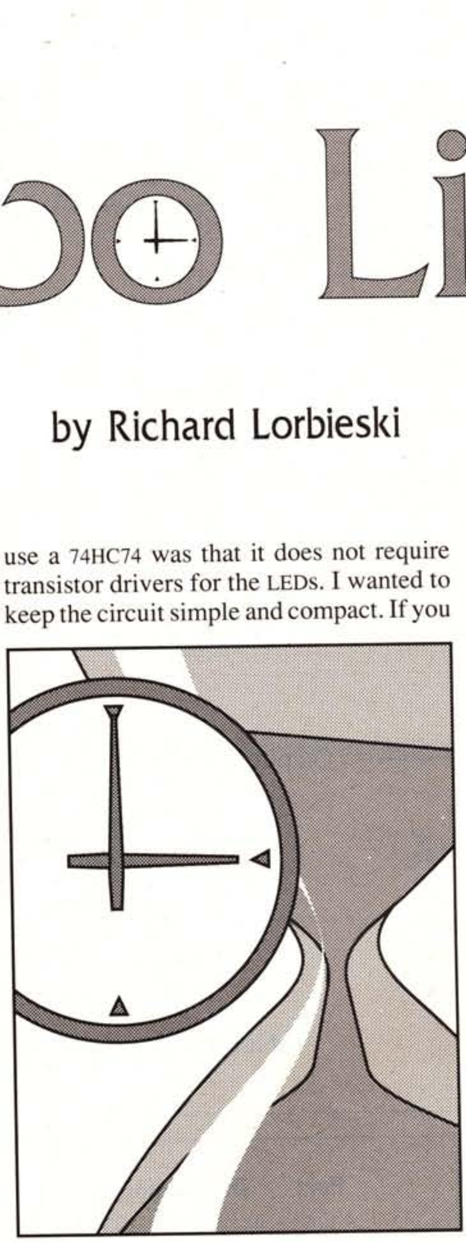
A bright idea for monitoring clock speed on the CoCo 3

Turbo Light

by Richard Lorbieski

Have you ever wondered at which clock speed your CoCo 3 is operating? The only way to tell whether the computer is in the high- or low-speed mode is with BASIC. If you type `POKE 65497,0` (the high-speed poke) after power up, you'll notice the cursor blinks faster. This means the computer is in the high-speed mode, but this is a crude way of checking the clock speed. Furthermore, if you're in a program or using OS-9, it's impossible to tell at which speed the CoCo is running. Unfortunately, Tandy did not include a "turbo" indicator light for the CoCo 3. I have designed a circuit that indicates when it is running at 0.89 MHz and when it is set to 1.78 MHz.

The turbo board is a great first project. It is simple and compact. There are no traces to cut on the main board, and no software modifications are necessary. The project requires only a handful of components and can be built in one evening. Most of the parts can be purchased at Radio Shack or at a local electronics supply house. However, the 74HC74 might not be an in-stock item at the local supply store. Therefore, you may have to order one. The reason I decided to use a 74HC74 was that it does not require transistor drivers for the LEDs. I wanted to keep the circuit simple and compact. If you are unable to locate a 74HC74, try Jameco Computer Products (1355 Shoreway Road, Belmont, CA 94002, 415-592-8097) or JDR Microdevices (2233 Branham Lane, San Jose, CA 95124, 800-538-5001). Or contact me and I'll try to help you find one.



Theory of Operation

The E clock from the Color Computer is fed into Pin 1 of the 74LS123 (U1) and Pin 2 of the 74HC74 (U2). The trigger timer is set by the input to pins 14 and 15 of U1. The duration of the trigger is controlled by R1 and C1. The trigger output on Pin 4 of U1 is designed to last between 560ns and 1020ns. Figure 1 shows how U2 operates. When the output of U1 is "timed-out" in the 0.89-MHz mode of the CoCo 3, Pin 6 of U2 is enabled and goes High, thus lighting the red LED. However, when U1 is timed-out in the 1.78-MHz mode, Pin 5 of U2 goes High activating the green LED.

Building the Project

This project is designed for newcomers as well as hardware gurus. But for newcomers to building electronic projects, it is highly recommended that someone with experience help you build this circuit to avoid the possibility of an improper connection destroying your Color Computer. All the components can be mounted on a small printed circuit board.

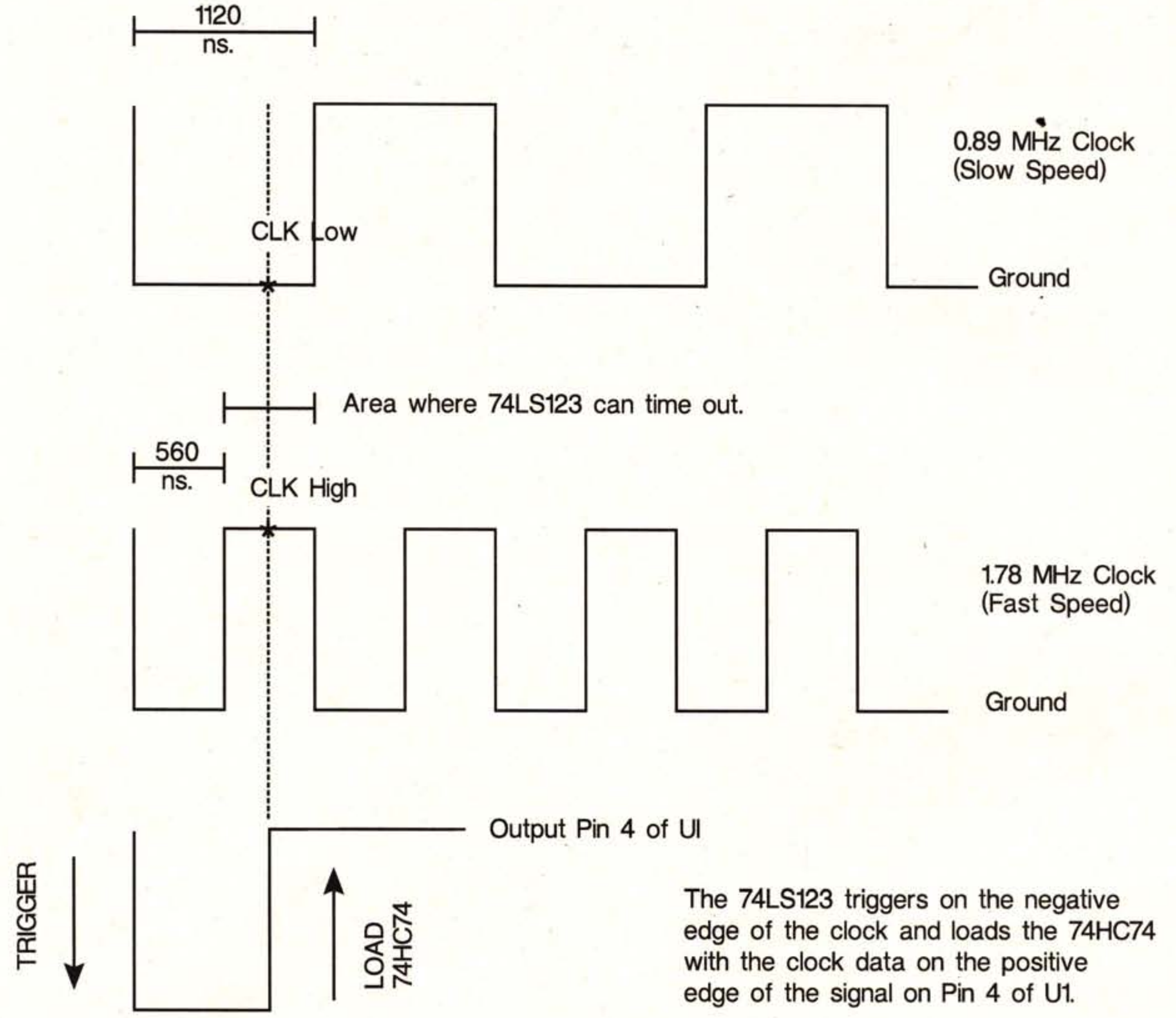
Figure 2 is the parts list for this project. Not shown in the schematic (Figure 3) are the power connections for the ICs. Vcc is the +5 volt line. The pins on U1 and U2 for +5 volts and Ground are as follows:

IC	+5 Volts	Ground
U1	8	16
U2	7	14

Decoupling capacitors (0.1 µF) are used to filter any noise in the +5 volt line and one should be mounted close to each IC. One lead of each capacitor is connected to the +5-volt line and the other lead goes to Ground. I recommend you use sockets for the IC so, in case of malfunction, they can be replaced without desoldering the chip from the board. Another tip is to mount a connector to the

---

Richard Lorbieski is a computer science major at Texas A&M University. He has been programming with the CoCo since 1983 and especially enjoys using BASIC09 and C with OS-9 Level II. He can be contacted at 1504 Hawktree, College Station, TX 77845. Please include an SASE when requesting a reply. His username on Delphi is RLORBIESKI.



The 74LS123 triggers on the negative edge of the clock and loads the 74HC74 with the clock data on the positive edge of the signal on Pin 4 of U1.

Figure 1

project board and use a cable with a connector that matches the board connector. This makes it unnecessary to desolder wires on the project board to open the computer case.

The best place to connect the cable wires is to the 68B09E microprocessor (labeled IC1 on the main board). Solder the wires on the bottom side of the main board and route them to the top. This avoids putting excessive heat on the CPU when soldering. Solder the Ground wire to Pin 1, the +5-volt wire to Pin 7, and the E-clock wire to Pin 34. Before going any further, double check your work.

Installation and Testing

The best place to mount the board is on the underside of the top of the case. Mount it 2 to 3 inches from the ROM cartridge port and 2 to 3 inches from the back of the CoCo. Before mounting the board, test the circuit.

Part	Description
U1	74LS123
U2	74HC74
R1	620-ohm resistor
R2,R3	330-ohm resistor
C1	.001-µf capacitor

Misc. 0.1-µF capacitors (2) for the ICs, one red and one green LED, IC sockets, and one small project board.

Figure 2: Parts List

On power up, the red LED should immediately light. Next, enter `POKE 65497,0` (high-speed poke) and the green LED should light. If the green LED fails to operate, recheck your connections. If they are correct, change the value of R1. Use a resistor between 500 to 700 ohms. It is better to start with a lower value and increase it until the unit functions properly. To restore the CoCo to normal, enter `POKE 65496,0` (low-speed poke). If everything works, install the turbo board inside the CoCo 3.

At this time I do not have access to a CoCo 1 or 2. Therefore, I cannot guarantee the board works using the undocumented high-speed pokes on those computers. Perhaps in the future I can try it on an older CoCo. If so, I'll report my findings on Delphi. I hope the turbo board helps you. ❑

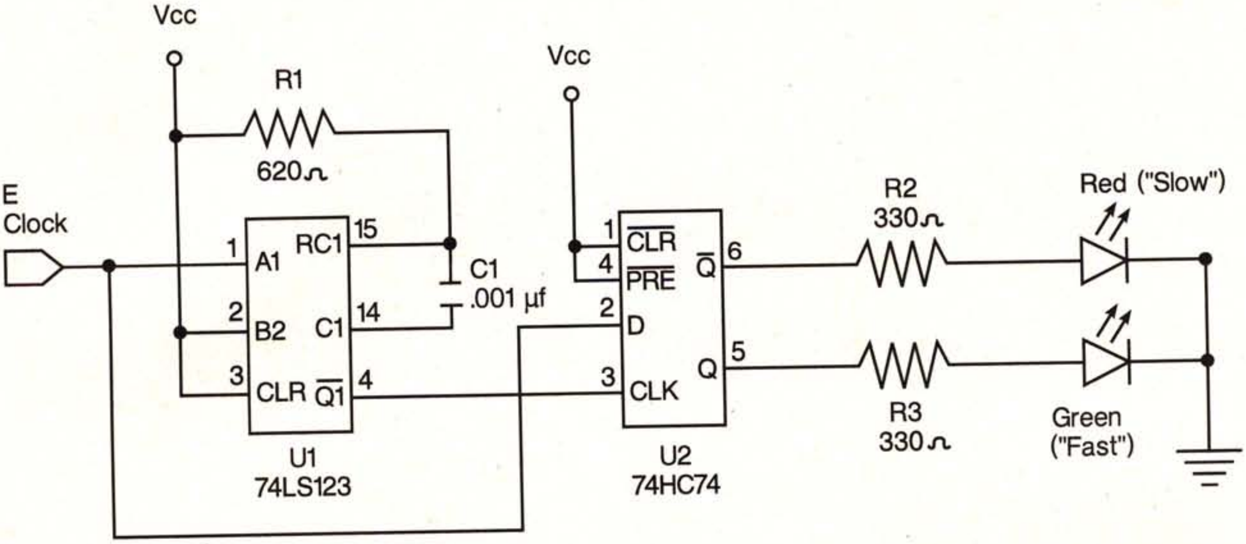


Figure 3

Novices Niche

Finance Utility 4K

Compound Interest

by Marvyn Hooper

This is a very short, yet useful program that compounds interest in annual, semiannual, monthly or daily periods. Simply run the program and enter the amount in question (savings, a loan, etc.). Next enter the interest rate and the term. Press the appropriate key for the method by which interest is calculated (A, S, M or D) and the results appear on the screen. Press ENTER for another calculation or BREAK to quit.

`COMP-INT` runs on the CoCo 1, 2 or 3. I think you will find the program to be very useful.

The Listing: `COMP-INT`

```
1 'COMPUND INTEREST
2 'WRITTEN BY MARVYN HOOPER
3 'COPYRIGHT FEBRUARY 1991
4 'BY FALSOFT, INC.
5 'RAINBOW MAGAZINE
10 CLS:PRINT"*COMPOUND INTEREST
CALCULATIONS*"
20 INPUT"AMOUNT";A
30 INPUT"INT.RATE";R
40 INPUT"YEARS";Y
50 PRINT"PERIOD    (A)NNUAL  (S)E
MI ANNUAL          (M)ONTHLY (D)A
ILY"
60 A$=INKEY$
70 IFA$="A"THEN80ELSEIFA$="S"THE
N110ELSEIFA$="M"THEN120ELSEIFA$=
"D"THEN130ELSE60
80 PRINT@330,"** ANNUAL **"
90 E=(1+R/100)^Y:T=A*E
100 PRINT@418,"TOTAL AMOUNT=";T:
EXEC44539:GOTO10
110 PRINT@327,"** SEMI-ANNUAL **
":Y=Y*2:R=R/2:GOTO90
120 PRINT@328,"** MONTHLY **":Y=
Y*12:R=R/12:GOTO90
130 PRINT@330,"** DAILY **":Y=Y*
365:R=R/365:GOTO90
```

The Assembly Line
Food for Thought

by William P. Nee

A great use for the computer is playing "what if" scenarios. Enter a bunch of variables, sit back, let your CoCo do all the work crunching numbers, and review the results. This month's program does just that with a simulation called *Predator*.

A "world" appears as a 64-by-32 grid. The grid wraps around, so if you go off the right edge, you'll end up back at the left edge; or if you go off the bottom you'll be back at the top. Three different animals inhabit this world. The first animal can only move around and reproduce — it is mainly food for the others. Animal 2 is a predator that can move, reproduce, and eat Animal 1. The third animal is another predator that can move, reproduce, and eat both animals 1 and 2. The two predators also starve if they don't eat within a specified time.

Here's where you get to join in: You decide how many of each animal there will be, at what age they may reproduce, and how long animals 2 and 3 can go without eating before they starve. Based on this information, the computer plots all the animals' initial locations on a random basis and moves them according to the values you have selected and also on these rules:

Animal 1 — moves only to vacant squares and can reproduce when it reaches the specified age.

Animal 2 — tries to move first to a square occupied by Animal 1. If there aren't any, it moves to a vacant square. It starves if it doesn't eat within the time specified by you, and it can reproduce when it reaches the age you picked and it's full.

Animal 3 — same as Animal 2 except it first tries to eat Animal 1 or Animal 2.

Moves are made on a random basis to a neighbor directly north, south, east, or west. An animal can reproduce only after it has moved or eaten, then both its old and new locations start with a new age of 1 and an "eat value" of 1. Eating another animal increases that animal's eat value, which cannot exceed the initially assigned value. Not eating for a period of time decreases the animal's eat value. If the eat value reaches zero, the animal starves and is removed from the program.

To plot all this information, the program uses four arrays: Current locations, moved-to locations, ages, and eat values. For other simulations in this series, you changed the status of just the current cell, but the information wasn't updated until the redisplay. In this simulation, you are immediately moving the contents of this cell to a new location. If you don't keep track of where an animal has been moved, you'll think it's a new one every time you run into it. So any time an animal moves, the Move array must also be updated. When an animal moves, all it's information moves with it. The display starts in PMODE 1,1 and switches to PMODE1,3 for the next generation. The program keeps alternating between these two pages for each new generation. All the initial information for each animal is poked into the machine-language program by the BASIC program.

The machine-language program in Listing 2 is long because a lot of it is repeated for each animal. I did this rather than have several subroutines — a BSR takes so much time and there is plenty of memory. Lines 100-370 assign all the variables. The four arrays are then cleared to zero. Routine Lone picks a random location within the Current array. If this location is occupied it tries another, but if it's vacant it stores a 1 there and puts a random age at the same location in the Age array. This continues for however many animals you chose.

The same general procedure is followed in routine LTWO (Lines 660-950) with the addition of a random eat value stored at the same location in the Eat array. The LTHREE routine first checks to see if you want any of them. If you don't, the program goes right to the initial display. Otherwise the routine is the same as LTWO.

Because all the variables begin with #$50, the DP register is set for this value in SHOW (Lines 1430-1860). Now the computer automatically assigns a #$50 in front of any location. Line 1510 clears the Move array since every location in it must be set to zero at the beginning of each generation. Lines 1570 and 1630 center the display on the screen.

Routine MOVE1 begins the actual computations. The program goes through the Current array until it finds a 1. It then checks the same location in the Move array to be sure that the 1 isn't actually the result

---

Bill Nee bucked the snowbird trend by retiring to Wisconsin from a banking career in Florida. The success of his 13-part series, "Machine Language Made BASIC" (July 1988 to July 1989), prompted him to continue writing articles on Color Computer machine-language programming. You may contact Bill at Route 2, Box 216C, Mason, WI 54856-9302.

of a previous move. If it isn't, the animal's age is increased, but not to exceed the maximum age. Lines 2140-2210 clear the four direction options and start the random counter with a 4. If after four tries Animal 1 can't move, the program moves on to the next cell.

Subroutine `RANDOM` (Lines 7120-7470) uses a timer counter to simulate the CoCo's internal clock. The time keeps changing, and it is certainly faster than using the `RND` command. A random direction (0-3) is computed, and if that direction hasn't previously been picked, the program goes to the corresponding routine where new locations are assigned:

```
R0 = (X,(Y-1) AND 31)
R1 = ((X-1) AND 63,Y)
R2 = ((X+1) AND 63,Y)
R3 = (X,(Y+1) AND 31)
```

The `AND 31` or `AND 63` accomplishes the wrap-around feature. This new location in the Current array is checked to see if it's vacant. If not, a new random location is picked. The same location in the Move array is checked (Lines 2240-2350). If it's clear, a 1 is stored in the new location (Lines 2360-2400) and the old location and age are set to zero (Lines 2410-2550). The age is then transferred to the new location. Line 2560 checks to see if the animal can reproduce. If it can, the old location and age are set to 1. Every cell in the array is checked in this manner.

The `TWO` routine follows the same procedure, except that in Line 3290 it first checks to see if it can locate and eat Animal 1 in any of it's four adjacent squares. If not, it goes to `STARV2` where its eat value is reduced by one. When this value reaches zero, all traces of the animal are wiped out (Lines 3880-3970). If it's still alive, the animal tries to move (Lines 3990-4610) just as Animal 1 did. When it has moved or eaten, is the proper age and has a full eat value, the animal can reproduce (Lines 4630-4840). Again, both new animals start with 1s for their ages and eat values.

Routine `THREE` is exactly the same, except that it checks for Animal 1 or Animal 2 when it tries to eat (Lines 5400-5440). At the end of the `THREE` routine the `DP` register is set back to zero and the program returns to either `PAGE1` or `PAGE3` where the new display is shown. The only way to stop the program is to push the reset button. When you've entered the program, check for errors with `A/NO/NS/WE`, save the source code with `W PREDATOR.ASM`, and assemble it with `A PREDATOR.BIN /NS/WE`.

The `BASIC` program (Listing 1) clears space for the machine-language program and, if necessary, loads it. The screen is set to Color Set 1 and a random value is poked into the timer. Your data for the animals is read and poked into the proper locations. Data is recorded as follows:

- — The number of Animal 1 (try values from 50 to 200)
- — The age at which Animal 1 reproduces (try 3 to 6)
- — The number of Animal 2 (try values from 20 to 100)
- — The age at which Animal 2 reproduces (try 10 to 20)
- — How long Animal 2 can go without eating (try 5 to 15)
- — The number of Animal 3 (from zero to about 10)
- — The age at which Animal 3 reproduces (try 10 to 40)
- — How long Animal 3 can go without eating (try 3 to 6)

You can use any positive numbers for these values. After all, that's the fun of experimenting. Some values cause animals 2 and 3 to dominate and extinguish Animal 1. Other values allow Animal 1 to completely fill the display. When you find values you like, save them as data lines and work on them later. Since the initial locations were set on a random basis, the same data may have different results when rerun. But that's a lot like life itself.

You can change Animal 3 and let it eat only Animal 2 by deleting Lines 5410-5420. Another variation is to let animals 2 and 3 reproduce, regardless of their eat values, by deleting lines 4670-4700 and lines 6810-6840. This process allows them to reproduce more quickly, so you might want to start with less of them. You could even add a fourth animal since the CoCo allows four colors. Feel free to experiment with the program and the animal data. Even small changes may produce major results.

Next time we'll look at how to sort word strings with machine language, as well as how to create a word-search puzzle. If you have any suggestions or ideas for future installments, please send them along. ❑

32K Disk

Listing 1: PREDATOR

```
1 'THE ASSEMBLY LINE
2 'WRITTEN BY WILLIAM NEE
3 'COPYRIGHT (C) APRIL 1991
4 'BY FALSOFT, INC.
5 'RAINBOW MAGAZINE
10 CLEAR 200,&H5000-1
20 X=RND(-TIMER)
30 POKE &HC1,8:POKE&H500F,RND(3)
40 IF PEEK(&H5027)<>142 THEN LOA
DM"PREDATOR":POKE&HFF40,0
50 FOR N=0 TO 7:READ X:POKE &H50
00+N,X:NEXT
60 PMODE1,1:PCLS
70 PMODE1,3:PCLS
80 CLS:PRINT@103,"LOADING  DATA"
90 PRINT@167,"ANIMAL1 -";PEEK(&H
5000)::PRINT@203,"AGE -";PEEK(&H
5001)
100 PRINT@263,"ANIMAL2 -";PEEK(&
H5002):PRINT@299,"AGE -";PEEK(&H
5003):PRINT@331,"EAT -";PEEK(&H5
003)
110 PRINT@391,"ANIMAL3 -";PEEK(&
H5005):PRINT@427,"AGE -";PEEK(&H
5006):PRINT@459,"EAT -";PEEK(&H5
007)
120 EXEC &H5027
```

Listing 2: PREDATOR

```
00100 *PREDATORS
00110          ORG     $5000
00120 NUM1     RMB     1
00130 ONEAGE   RMB     1
00140 NUM2     RMB     1
00150 TWOAGE   RMB     1
00160 TWOEAT   RMB     1
00170 NUM3     RMB     1
00180 THAGE    RMB     1
00190 THEAT    RMB     1
00200 ACROSS   RMB     1
00210 DOWN     RMB     1
00220 TEMP     RMB     1
00230 RANDY    RMB     4
00240 TIMER    RMB     1
00250 RCOUNT   RMB     1
00260 NEWX     RMB     1
00270 NEWY     RMB     1
00280 OLDLO    RMB     2
00290 NEWLO    RMB     2
00300 OCURR    RMB     2
00310 NCURR    RMB     2
00320 OMOVE    RMB     2
00330 NMOVE    RMB     2
00340 OAGE     RMB     2
00350 NAGE     RMB     2
00360 OEAT     RMB     2
00370 NEAT     RMB     2
00380
00390 START    LDX     #ARAYC  CLEAR ALL ARRAYS
00400          LDD     #0
00410 L1       STD     ,X++
00420          CMPX    #ARAYC+8192
00430          BLO     L1
00440
00450 LONE     LDB     NUM1
00460          STB     TEMP
00470 L2       LDD     #2048   GET RANDOM LOCATION
00480          JSR     $B4F4
00490          JSR     $BF1F
00500          JSR     $B3ED
00510          SUBD    #1
00520          LDX     #ARAYC
00530          TST     D,X
00540          BNE     L2      ALREADY OCCUPIED
00550          INC     D,X     STORE A '1' THERE
00560          LDY     #ARAYA
00570          LEAY    D,Y
00580          LDB     ONEAGE  RANDOM AGE
00590          JSR     $BC7C
```

```
00600          JSR     $BF1F
00610          JSR     $B3ED
00620          STB     ,Y
00630          DEC     TEMP     ANY MORE?
00640          BNE     L2
00650
00660 LTWO     LDB     NUM2
00670          STB     TEMP
00680 L3       LDD     #2048
00690          JSR     $B4F4
00700          JSR     $BF1F
00710          JSR     $B3ED
00720          SUBD    #1
00730          LDX     #ARAYC
00740          TST     D,X
00750          BNE     L3
00760          INC     D,X      STORE A '2' THERE
00770          INC     D,X
00780          STD     OLDLO
00790          LDY     #ARAYA
00800          LEAY    D,Y
00810          LDB     TWOAGE
00820          JSR     $BC7C
00830          JSR     $BF1F
00840          JSR     $B3ED
00850          STB     ,Y
00860          LDD     OLDLO
00870          LDY     #ARAYE
00880          LEAY    D,Y
00890          LDB     TWOEAT   GET RANDOM EAT
00900          JSR     $BC7C
00910          JSR     $BF1F
00920          JSR     $B3ED
00930          STB     ,Y
00940          DEC     TEMP
00950          BNE     L3
00960
00970 LTHREE   TST     NUM3     ARE THERE ANY?
00980          BEQ     PAGE1
00990          LDB     NUM3
01000          STB     TEMP
01010 L4       LDD     #2048
01020          JSR     $B4F4
01030          JSR     $BF1F
01040          JSR     $B3ED
01050          SUBD    #1
01060          LDX     #ARAYC
01070          TST     D,X
01080          BNE     L4
01090          INC     D,X      STORE A '3' THERE
01100          INC     D,X
01110          INC     D,X
01120          STD     OLDLO
01130          LDY     #ARAYA
01140          LEAY    D,Y
01150          LDB     THAGE
01160          JSR     $BC7C
01170          JSR     $BF1F
01180          JSR     $B3ED
01190          STB     ,Y
01200          LDY     #ARAYE
01210          LDD     OLDLO
01220          LEAY    D,Y
01230          LDB     THEAT
01240          JSR     $BC7C
01250          JSR     $BF1F
01260          JSR     $B3ED
01270          STB     ,Y
01280          DEC     TEMP
01290          BNE     L4
01300
01310 PAGE1    LDB     #1
01320          JSR     $9653
01330          BSR     SHOW
01340          LDB     #1       SCREEN 1
01350          JSR     $95AA
01360 PAGE3    LDB     #3
01370          JSR     $9653
01380          BSR     SHOW
01390          LDB     #1
01400          JSR     $95AA
01410          BRA     PAGE1
01420
01430          SETDP   $50      SINCE VARIABLES ARE HERE
01440 SHOW     LDA     #$50
01450          TFR     A,DP
01460          LDY     #ARAYC
01470          CLRA
01480 L5       STA     DOWN
01490          CLRB
01500 L6       STB     ACROSS
01510          CLR     2048,Y   CLEAR ARRAY 'MOVE',TOO
01520          LDA     ,Y+       GET VALUE 0-3
01530          LDB     #$55
01540          MUL
01550          STB     >$B5
01560 PSET     LDA     DOWN
01570          ADDA    #32      CENTER DISPLAY
01580          LDB     #32
01590          MUL
01600          ADDA    $BA
01610          TFR     D,X
01620          LDB     ACROSS
01630          ADDB    #32      CENTER DISPLAY
01640          LSRB
01650          LSRB
01660          ABX
01670          LDA     ACROSS
01680          ADDA    #32
01690          ANDA    #3
01700          LDU     #$92E5
01710          LDA     A,U
01720          TFR     A,B
01730          COMA
01740          ANDA    ,X
01750          ANDB    $B5
01760          STB     TEMP
01770          ORA     TEMP
01780          STA     ,X
01790          LDB     ACROSS
01800          INCB
01810          CMPB    #64
01820          BLO     L6
01830          LDA     DOWN
01840          INCA
01850          CMPA    #32
01860          BLO     L5
01870
01880 MOVE1    CLRA
01890 L7       STA     DOWN
01900          CLRB
01910 L8       STB     ACROSS
01920          LDA     DOWN
01930          LDB     #64
01940          MUL
01950          ADDB    ACROSS
01960          ADCA    #0
01970          STD     OLDLO    CURRENT LOCATION
01980          LDX     #ARAYC
01990          LDA     D,X
02000          CMPA    #1
02010          LBNE    L11      SKIP OVER THIS
02020          LDY     #ARAYM
02030          LDD     OLDLO
02040          TST     D,Y      IS THIS A MOVE?
02050          LBNE    L11
02060          LDY     #ARAYA
02070          LEAY    D,Y
02080          LDA     ,Y
02090          INCA             INCREASE AGE
02100          CMPA    ONEAGE
02110          BLE     L9
02120          LDA     ONEAGE
02130 L9       STA     ,Y
```

```
02140          LDU    #RANDY
02150          CLR    ,U+      CLEAR THE 4 DIRECTIONS
02160          CLR    ,U+
02170          CLR    ,U+
02180          CLR    ,U
02190          LDA    #5
02200          STA    RCOUNT
02210 L10      DEC    RCOUNT   JUST 4 OF THEM
02220          LBEQ   L11      GOOD TRY!
02230          LBSR   RANDOM
02240          LDB    NEWY
02250          LDA    #64
02260          MUL
02270          ADDB   NEWX
02280          ADCA   #0
02290          STD    NEWLO    NEW LOCATION
02300          LDX    #ARAYC
02310          TST    D,X      IS IT VACANT?
02320          BNE    L10
02330          LDY    #ARAYM
02340          TST    D,Y      ANY MOVES THERE?
02350          BNE    L10
02360          LEAX   D,X
02370          LEAY   D,Y
02380          LDA    #1       OK, OCCUPY IT
02390          STA    ,X
02400          STA    ,Y
02410          LDX    #ARAYC
02420          LDY    #ARAYM
02430          LDD    OLDLO
02440          CLR    D,X      VACATE OLD LOCATION
02450          CLR    D,Y
02460          LDY    #ARAYA
02470          LEAY   D,Y
02480          LDA    ,Y
02490          CLR    ,Y       CLEAR OLD AGE
```

```
02500          STA    TEMP
02510          LDD    NEWLO
02520          LDY    #ARAYA
02530          LEAY   D,Y
02540          LDA    TEMP
02550          STA    ,Y       STORE NEW AGE
02560          CMPA   ONEAGE   REPRODUCE YET?
02570          BNE    L11
02580          LDX    #ARAYC
02590          LDY    #ARAYM
02600          LDD    OLDLO
02610          LEAX   D,X
02620          LEAY   D,Y
02630          LDA    #1       YES!
02640          STA    ,X
02650          STA    ,Y
02660          LDX    #ARAYA
02670          LDY    #ARAYA
02680          LDD    OLDLO
02690          LEAX   D,X
02700          LDD    NEWLO
02710          LEAY   D,Y
02720          LDA    #1       START AT AGE 1
02730          STA    ,X
02740          STA    ,Y
02750 L11      LDB    ACROSS
02760          INCB
02770          CMPB   #64
02780          LBLO   L8
02790          LDA    DOWN
02800          INCA
02810          CMPA   #32
02820          LBLO   L7
02830
02840 TWO      CLRA
02850 L12      STA    DOWN
```

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News About Upcoming Products...

We have a lot of new products under development right now, both for the Color Computer 3 and for the new OS9-68000 machines. A few of the products you can expect to see over the next few months are the OSKenLook user interface for OS9/OSK; the PIXELBOX adapter that lets you use LogiTech ScanMan handheld scanners with the CoCo 3, and OSK ports of several popular Burke & Burke utility packages. Stop by our booth at the Chicago Rainbowfest for the latest news! -- Chris Burke

CyberVoice speaks well for OS9!

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```
02860            CLRB
02870 L13        STB      ACROSS
02880            LDA      DOWN
02890            LDB      #64
02900            MUL
02910            ADDB     ACROSS
02920            ADCA     #0
02930            STD      OLDLO
02940            LDX      #ARAYC
02950            LDA      D,X
02960            CMPA     #2
02970            LBNE     LOOP2
02980            LDY      #ARAYM
02990            LDD      OLDLO
03000            TST      D,Y
03010            LBNE     LOOP2
03020            LDY      #ARAYA
03030            LEAY     D,Y
03040            LDA      ,Y
03050            INCA
03060            CMPA     TWOAGE
03070            BLE      L14
03080            LDA      TWOAGE
03090 L14        STA      ,Y
03100            LDU      #RANDY
03110            CLR      ,U+
03120            CLR      ,U+
03130            CLR      ,U+
03140            CLR      ,U
03150            LDA      #5
03160            STA      RCOUNT
03170 L15        DEC      RCOUNT
03180            LBEQ     STARV2    NO FOOD TODAY
03190            LBSR     RANDOM
03200            LDB      NEWY
03210            LDA      #64
03220            MUL
03230            ADDB     NEWX
03240            ADCA     #0
03250            STD      NEWLO
03260            LDX      #ARAYC
03270            LEAX     D,X
03280            LDA      ,X
03290            CMPA     #1        ANY FOOD HERE?
03300            BNE      L15
03310            LDA      #2        EAT IT
03320            STA      ,X
03330            STX      NCURR
03340            LDX      #ARAYA
03350            LDY      #ARAYE
03360            LDU      #ARAYM
03370            LDD      NEWLO
03380            LEAX     D,X
03390            STX      NAGE
03400            LEAY     D,Y
03410            STY      NEAT
03420            LEAU     D,U
03430            STU      NMOVE
03440            LDX      #ARAYE
03450            LDY      #ARAYC
03460            LDU      #ARAYM
03470            LDD      OLDLO
03480            LEAX     D,X
03490            STX      OEAT
03500            LEAY     D,Y
03510            STY      OCURR
03520            LEAU     D,U
03530            STU      OMOVE
03540            LDX      #ARAYA
03550            LEAX     D,X
03560            STX      OAGE
03570            LDX      NAGE
03580            CLR      ,X
03590            LDX      OEAT
03600            LDA      ,X
03610            CLR      ,X        CLEAR OLD EAT
03620            INCA               INCREASE NEW EAT
```

```
03630            CMPA     TWOEAT
03640            BLE      L16
03650            LDA      TWOEAT
03660 L16        LDX      NEAT      AND STORE IT
03670            STA      ,X
03680            LDX      NMOVE
03690            LDA      #2
03700            STA      ,X
03710            LDX      OCURR
03720            CLR      ,X
03730            LDX      OMOVE
03740            CLR      ,X
03750            LDX      OAGE
03760            LDY      NAGE
03770            LDA      ,X
03780            CLR      ,X
03790            STA      ,Y
03800            LBRA     TWOREP
03810
03820 STARV2     LDX      #ARAYE
03830            LDD      OLDLO
03840            LEAX     D,X
03850            LDA      ,X
03860            DECA               DECREASE EAT
03870            STA      ,X
03880            TST      ,X        DOWN TO '0' YET?
03890            BNE      MOVE2
03900            LDX      #ARAYC    YES
03910            LDD      OLDLO     CLEAR OUT EVERYTHING
03920            CLR      D,X
03930            LDX      #ARAYA
03940            CLR      D,X
03950            LDX      #ARAYM
03960            CLR      D,X
03970            LBRA     LOOP2
03980
03990 MOVE2      LDU      #RANDY
04000            CLR      ,U+
04010            CLR      ,U+
04020            CLR      ,U+
04030            CLR      ,U
04040            LDA      #5
04050            STA      RCOUNT
04060 L17        DEC      RCOUNT
04070            LBEQ     LOOP2     COULDN'T MOVE EITHER
04080            LBSR     RANDOM
04090            LDB      NEWY
04100            LDA      #64
04110            MUL
04120            ADDB     NEWX
04130            ADCA     #0
04140            STD      NEWLO
04150            LDX      #ARAYC
04160            LEAX     D,X
04170            TST      ,X        OCCUPIED?
04180            BNE      L17
04190            STX      NCURR
04200            LDX      #ARAYM
04210            LDY      #ARAYA
04220            LDU      #ARAYE
04230            LDD      NEWLO
04240            LEAX     D,X
04250            STX      NMOVE
04260            LEAY     D,Y
04270            STY      NAGE
04280            LEAU     D,U
04290            STU      NEAT
04300            LDX      #ARAYC
04310            LDY      #ARAYM
04320            LDU      #ARAYA
04330            LDD      OLDLO
04340            LEAX     D,X
04350            STX      OCURR
04360            LEAY     D,Y
04370            STY      OMOVE
04380            LEAU     D,U
04390            STU      OAGE
```

```
04400          LDX    #ARAYE
04410          LEAX   D,X
04420          STX    OEAT
04430          LDX    NCURR
04440          LDY    NMOVE
04450          LDA    #2
04460          STA    ,X
04470          STA    ,Y
04480          LDX    OCURR
04490          LDY    OMOVE
04500          CLR    ,X
04510          CLR    ,Y
04520          LDX    NAGE
04530          LDY    OAGE
04540          LDA    ,Y
04550          CLR    ,Y
04560          STA    ,X
04570          LDX    NEAT
04580          LDY    OEAT
04590          LDA    ,Y
04600          CLR    ,Y
04610          STA    ,X
04620
04630 TWOREP   LDX    NAGE
04640          LDA    ,X
04650          CMPA   TWOAGE  REPRODUCE YET?
04660          BLO    LOOP2
04670          LDX    NEAT
04680          LDA    ,X
04690          CMPA   TWOEAT  REPRODUCE YET?
04700          BLO    LOOP2
04710          LDX    OCURR
04720          LDY    OMOVE
04730          LDA    #2
04740          STA    ,X
04750          STA    ,Y
04760          LDX    NAGE
04770          LDY    OAGE
04780          LDA    #1
04790          STA    ,X
04800          STA    ,Y
04810          LDX    NEAT
04820          LDY    OEAT
04830          STA    ,X      BOTH START WITH '1' EAT
04840          STA    ,Y
04850
04860 LOOP2    LDB    ACROSS
04870          INCB
04880          CMPB   #64
04890          LBLO   L13
04900          LDA    DOWN
04910          INCA
04920          CMPA   #32
04930          LBLO   L12
04940
04950 THREE    CLRA
04960 L18      STA    DOWN
04970          CLRB
04980 L19      STB    ACROSS
04990          LDA    DOWN
05000          LDB    #64
05010          MUL
05020          ADDB   ACROSS
05030          ADCA   #0
05040          STD    OLDLO
05050          LDX    #ARAYC
05060          LDA    D,X
05070          CMPA   #3
05080          LBNE   LOOP3
05090          LDY    #ARAYM
05100          LDD    OLDLO
05110          TST    D,Y
05120          LBNE   LOOP3
05130          LDY    #ARAYA
05140          LEAY   D,Y
05150          LDA    ,Y
05160          INCA
05170          CMPA   THAGE
05180          BLE    L20
05190          LDA    THAGE
05200 L20      STA    ,Y
05210
05220 EAT3     LDU    #RANDY
05230          CLR    ,U+
05240          CLR    ,U+
05250          CLR    ,U+
05260          CLR    ,U
05270          LDA    #5
05280          STA    RCOUNT
05290 L21      DEC    RCOUNT
05300          LBEQ   STARV3
05310          LBSR   RANDOM
```

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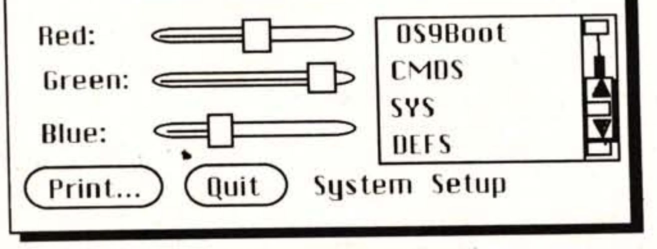

OSKenLook: The Next Interface...

Kyum-Gai: to be Ninja (OS-9 Version) is the culmination of a project started almost a year ago. The talents of *Glen R. Dahlgren* (RS-DOS game writer for Sundog Systems), *Kevin Darling* (a legend for his work in OS-9), and *Eddie Kuns* (author of KBCom) have been pooled to create a masterpiece of game software under the OS-9 operating system. Fast martial arts action with outstanding graphics, great digitized sound effects, and incredible animation are featured in this arcade game, all in the OS-9 environment.

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```
05320          LDB     NEWY
05330          LDA     #64
05340          MUL
05350          ADDB    NEWX
05360          ADCA    #0
05370          STD     NEWLO
05380          LDX     #ARAYC
05390          LEAX    D,X
05400          LDA     ,X
05410          CMPA    #1       IS THIS FOOD?
05420          BEQ     L21A
05430          CMPA    #2       HOW ABOUT THIS?
05440          BNE     L21
05450 L21A     LDA     #3       GOTCHA!
05460          STA     ,X
05470          STX     NCURR
05480          LDX     #ARAYA
05490          LDY     #ARAYE
05500          LDU     #ARAYM
05510          LDD     NEWLO
05520          LEAX    D,X
05530          STX     NAGE
05540          LEAY    D,Y
05550          STY     NEAT
05560          LEAU    D,U
05570          STU     NMOVE
05580          LDX     #ARAYE
05590          LDY     #ARAYC
05600          LDU     #ARAYM
05610          LDD     OLDLO
05620          LEAX    D,X
05630          STX     OEAT
05640          LEAY    D,Y
05650          STY     OCURR
05660          LEAU    D,U
05670          STU     OMOVE
05680          LDX     #ARAYA
05690          LEAX    D,X
05700          STX     OAGE
05710          LDX     NAGE
05720          CLR     ,X
05730          LDX     OEAT
05740          LDA     ,X
05750          CLR     ,X
05760          INCA
05770          CMPA    THEAT
05780          BLE     L22
05790          LDA     THEAT
05800 L22      LDX     NEAT
05810          STA     ,X
05820          LDX     NMOVE
05830          LDA     #3
05840          STA     ,X
05850          LDX     OCURR
05860          CLR     ,X
05870          LDX     OMOVE
05880          CLR     ,X
05890          LDX     OAGE
05900          LDY     NAGE
05910          LDA     ,X
05920          CLR     ,X
05930          STA     ,Y
05940          LBRA    THREP
05950
05960 STARV3   LDX     #ARAYE
05970          LDD     OLDLO
05980          LEAX    D,X
05990          LDA     ,X
06000          DECA
06010          STA     ,X
06020          TST     ,X
06030          BNE     MOVE3    STILL ALIVE
06040          LDX     #ARAYC
06050          LDD     OLDLO
06060          CLR     D,X
06070          LDX     #ARAYA
06080          CLR     D,X
06090          LDX     #ARAYM
06100          CLR     D,X
06110          LBRA    LOOP3
06120
06130 MOVE3    LDU     #RANDY
06140          CLR     ,U+
06150          CLR     ,U+
06160          CLR     ,U+
06170          CLR     ,U
06180          LDA     #5
06190          STA     RCOUNT
06200 L23      DEC     RCOUNT
06210          LBEQ    LOOP3
06220          LBSR    RANDOM
06230          LDB     NEWY
06240          LDA     #64
06250          MUL
06260          ADDB    NEWX
06270          ADCA    #0
06280          STD     NEWLO
06290          LDX     #ARAYC
06300          LEAX    D,X
06310          TST     D,X
06320          BNE     L23
06330          STX     NCURR
06340          LDX     #ARAYM
06350          LDY     #ARAYA
06360          LDU     #ARAYE
06370          LDD     NEWLO
06380          LEAX    D,X
06390          STX     NMOVE
06400          LEAY    D,Y
06410          STY     NAGE
06420          LEAU    D,U
06430          STY     NEAT
06440          LDX     #ARAYC
06450          LDY     #ARAYM
06460          LDU     #ARAYA
06470          LDD     OLDLO
06480          LEAX    D,X
06490          STX     OCURR
06500          LEAY    D,Y
06510          STY     OMOVE
06520          LEAU    D,U
06530          STU     OAGE
06540          LDX     #ARAYE
06550          LEAX    D,X
06560          STX     OEAT
06570          LDX     NCURR
06580          LDY     NMOVE
06590          LDA     #3
06600          STA     ,X
06610          STA     ,Y
06620          LDX     OCURR
06630          LDY     OMOVE
06640          CLR     ,X
06650          CLR     ,Y
06660          LDX     NAGE     TRANSFER AGE
06670          LDY     OAGE
06680          LDA     ,Y
06690          CLR     ,Y
06700          STA     ,X
06710          LDX     NEAT     TRANSFER EAT
06720          LDY     OEAT
06730          LDA     ,Y
06740          CLR     ,Y
06750          STA     ,X
06760
06770 THREP    LDX     NAGE
06780          LDA     ,X
06790          CMPA    THAGE
06800          BLO     LOOP3
06810          LDX     NEAT
06820          LDA     ,X
06830          CMPA    THEAT
06840          BLO     LOOP3
06850          LDX     OCURR    CAN REPRODUCE
```

```
06860          LDY     OMOVE
06870          LDA     #3
06880          STA     ,X
06890          STA     ,Y
06900          LDX     NAGE
06910          LDY     OAGE
06920          LDA     #1
06930          STA     ,X
06940          STA     ,Y
06950          LDX     NEAT
06960          LDY     OEAT
06970          STA     ,X
06980          STA     ,Y
06990
07000 LOOP3    LDB     ACROSS
07010          INCB
07020          CMPB    #64
07030          LBLO    L19
07040          LDA     DOWN
07050          INCA
07060          CMPA    #32
07070          LBLO    L18
07080          CLRA
07090          TFR     A,DP       THAT'S ALL FOLKS
07100          RTS
07110
07120 RANDOM   LDB     TIMER
07130          INC     TIMER      CHANGE IT
07140          ANDB    #3         JUST WANT 0-3
07150          LDU     #RANDY
07160          TST     B,U        PICKED ALREADY?
07170          BNE     RANDOM
07180          INC     B,U        PICKED NOW
07190          CMPB    #3
07200          BEQ     R3
07210          CMPB    #2
07220          BEQ     R2
07230          CMPB    #1
07240          BEQ     R1
07250
07260 R0       LDD     ACROSS
07270          DECB               Y-1
07280          ANDB    #31        WRAP
07290          STD     NEWX       NEW LOCATION
07300          RTS
07310
07320 R1       LDD     ACROSS
07330          DECA               X-1
07340          ANDA    #63
07350          STD     NEWX
07360          RTS
07370 R2       LDD     ACROSS
07380          INCA               X+1
07390          ANDA    #63
07400          STD     NEWX
07410          RTS
07420
07430 R3       LDD     ACROSS
07440          INCB               Y+1
07450          ANDB    #31
07460          STD     NEWX
07470          RTS
07480
07490 ARAYC    RMB     2048       ARRAY CURRENT
07500 ARAYM    RMB     2048       ARRAY MOVE
07510 ARAYA    RMB     2048       ARRAY AGE
07520 ARAYE    RMB     2048       ARRAY EAT
07530
07540          END     START
```

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Sound Utility CoCo 1, 2 & 3

Delta Pro

The Color Computer has long been known by its users as a machine with a lot of potential, with more potential being realized every day. How can something already so good be improved? One way is to add software, giving the CoCo the ability to handle more tasks. The other way is to add hardware, which adds even more to the power of the computer, but is a little hard on our wallets. Adding both hardware and software is always the most expensive choice of all. However, going in this direction often adds the most "bang for the buck," or the greatest level of capabilities to the CoCo.

Such a product is Delta Pro. This specially designed ROM pack and accompanying software give the CoCo 1, 2 and 3 more capabilities for sound, speech and music. Delta Pro uses the delta, or change method, of sound recording. This technology allows a very high quality of sound reproduction with a very low sample rate, which means less use of precious memory. The delta encoder unit is capable of rates from 450 to 15,555 samples-per-second. Also included in the pack is an 8-channel, 8-bit analog joystick interface that provides a means to use high-resolution joystick movement, or can serve as 8-bit data acquisition ports to connect the CoCo with the outside world. Delta Pro also uses onboard audio filters to maximize audio response with respect to the sampling rate. In nontechnical terms, Delta Pro makes magnificent music, speech, and sound reproduction possible with the CoCo. Whether you are planning to play some spectacular games, produce educational material, use your computer to call the police or fire department (when it is used as a burglar alarm), or even to write your own musical scores, there are many uses for an audio acquisition and playback tool such as Delta Pro.

Let's take a look under the lid of this beast. Delta Pro is housed in a ROM pack with the standard 40-pin card-edge connector. Delta Pro has silver connectors, not gold, and appears to have been competently assembled. The solder connections are clean and the case layout is sensible. On the opposite end of the cartridge from the edge connector are three 3.5-millimeter jacks (these are standard sub-mini phono jacks): Two monophonic jacks (one for a line source, and the other for a microphone input), and a stereo-headphone jack. On the right side (facing away from the computer when installed in a Multi-Pak) are two 6-pin DIN female joystick ports. These replace the joystick ports on the CoCo if both sound and joystick/mouse input are required simultaneously. Next to the two joystick ports are two small holes, which lead to nothing and presumably are for future expansion. They would look a little neater either plugged, or not cut out. Also, the openings for the joystick ports, while firmly connected, are cut slightly larger than the connectors and show open space just above and below the connectors. This also has caused a minuscule, but visible, gap between the upper and lower halves of the case. But I am describing mere aesthetics. Otherwise, this is a solidly constructed unit.

The software that comes with Delta Pro consists of about 10 support programs to take immediate advantage of the package, and a demonstration program featuring animated graphics and digitized Delta Pro sound effects. Let's take a brief look at each of these.

At the heart of the software interfaces to Delta Pro is `DCOMM.BIN`. This program requires only about 5K, but gives the user 71 commands (for example, `CLOCK 215`; or `DPLAY 1`) and is very easy to learn for BASIC users. Novices will find it very much like learning BASIC, but a bit easier. Given that `DCOMM.BIN` is designed to handle audio recording, memory allocation, and storage and playback for the Delta Pro system, this

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is a very easy mini-language to learn. The commands, like the hardware, appear to be well-conceived and implemented, and are both easy to use and not failing in any major way. The manual thoroughly explains the variables to be used as arguments for the commands. `KEYWORD.BAS`, an undocumented program on the disk, lists each of `DCOMM.BIN`'s powerful commands to a printer or the screen.

Next is the `D3.BAS` program, a working implementation of `DCOMM.BIN` that allows Delta Pro to be used "right out of the box." `D3.BAS` is specifically for the CoCo 3. If you use a 64K CoCo, you must use the `D64K.BAS` program, which implements most of the same features as `D3.BAS`. `D64K.BAS` expects small files with a `.D64` extension.

The `D3` program is designed as a digital audio recorder and allows such features as Record, Playback, Clock Set, Filter Set, Sample Rate Set, Reverse Playback, Location Selection in sub-sound buffers, and, most powerful of all, a direct command interpreter link. This means you can control Delta Pro through `DCOMM.BIN` right from `D3.BAS`. The program is menu-oriented — just press a key and you go. One little aggravation is that the manual is less than clear on file-loading procedures. It took a while to determine that the interface expects a filename without quotes and without extensions. System memory permitting, multiple-file loading is possible. What the computer can hold in memory depends on its configuration and also the selected sample rate of the sound you are recording. If you want to get some real high-fidelity sound effects, you won't be able to store more than about 43 seconds of sound per file on a 512K computer.

The program `BOOT.BAS` serves as a loader for two other programs that use the Delta Pro pack: `DIGIVERB.BIN` and `PITCH.BIN`. These two programs are modifiers for recorded sound. The former is a reverberation module and the latter is a pitch-bending wheel. You can get some pretty wild effects using these two programs, which occupy only about 340 bytes of RAM each. Numerous examples are given in the documentation for interfacing and patching these programs to your own programming efforts in both machine language and BASIC. Programmers should have no difficulty at all modifying these modules. Novices can use the basic features until they learn more.

Included in the Delta Pro package is a demonstration program depicting *Star Trek: The Next Generation*. A credible display shows text scrolling across a background from The Borg Encounter episode (which I did not see). This is followed by a well-drawn screen of the *U.S.S. Enterprise* confronting something big, ugly and awful. The demo includes patched-in audio for voices, music and phaser fire. Apparently Captain Picard becomes one of these Borgs, and his digitized visage, along with his parting comments, provides a terrific effect. Heard through a television speaker, the sound quality is mediocre. Heard through stereo headphones or a stereo system, the sound is excellent. It is especially good considering the original sound source is a television set.

Delta Pro gives the CoCo 1, 2 & 3 more extended capabilities for sound, speech and music.

The 8½-by-11 inch, 37-page manual is a photocopy of a master manual. The print quality is legible. Mistakes in grammar, and spelling, and occasional typographical errors appear throughout the manual; they do not, however, greatly interfere with understanding the material. None of the errors I found were in the abundant technical discussions or programming examples. Four schematics at the end of the manual show complete circuit diagrams for the system.

The Delta Pro manual is designed for system programmers and technicians. It is possible for nonprogrammers and novices to successfully use Delta Pro, but this is not a point-and-click product.

The author's intentions are clear. The amount and variety of information provided in the manual is enough so that anyone who wants to incorporate any of the drivers, or sequencers, or any aspect of this product into their own programming can do so. Even novices can turn out reasonable results, given a little time and effort. The point is, we are not talking about "Getting Started" sections. The manual provides a thorough and detailed byte-for-byte discussion of interrupts, memory allocations and more. You are told how to use the joystick ports, and why the joystick ports on the Delta Pro pack are better than CoCo's. But what is the average user going to do now? Modify commercial gameware? Or put in a BASIC loader, only to find it is incompatible with a machine-language game? In this respect, Delta Pro is lacking. It would have been better to put these programming examples on the disk in usable form, with documentation that takes users step-by-step through the processes of successfully installing and running them. In my opinion, although the product is very good technically (and incredibly feature rich) it is in some ways inaccessible to the average user.

This leads me to question Delta Pro's targeted audience. Is it composed of average home users wanting to make music and sound effects, or game programmers wanting to make software that uses Delta Pro? Based on the type and volume of information in the manual, I believe the latter. Lucas Industries 2000 has developed an excellent product with Delta Pro, and the manual proves the company knows their stuff. But delivering this to users in a usable format is a real sticking point. On the other hand, the accompanying software allows pitch control, reverberation, sequencing, and all manner of digital control of sounds. A wide range of microphone inputs is supported (from dynamic to electret). The manual is full of examples and information, very technically oriented, for those who can make use of it. The system works, and works well.

Is Delta Pro a good value? It is if it suits your needs. Lucas Industries 2000 offers a 10-day in-home free trial offer and includes a 60-day warranty. If you are a user who does not have technical or programming experience, or if you need step-by-step guidelines, this product may be too technical and you will need help. If you need assistance, feel free to call Lucas Industries or send an SASE with your question.

Requirements for this program include a CoCo 1 or 2 with 64K, or a CoCo 3, one disk drive, and a Multi-Pak or Y cable. The final touches for a point-and-click interface for the CoCo 3 is an upgrade replacement for the `D3` program.

[*Editor's Note:* `DPMAX` *has been added to the Delta Pro package. This $29.95-value program features a point-and-shoot, real-time interface, pull-down windows, and jump-key sequences.* `DPMAX` *requires a CoCo 3 with a disk drive, a Multi-Pak Interface or Y cable, and a mouse or joystick.*]

(Lucas Industries 2000, 14720 Cedar St., N.E., Alliance, OH 44601; 216-823-4221; $129.95, plus $4 S/H; check, money order, or COD (add $4 for COD)

— Jeffrey S. Parker

Home Help CoCo 3

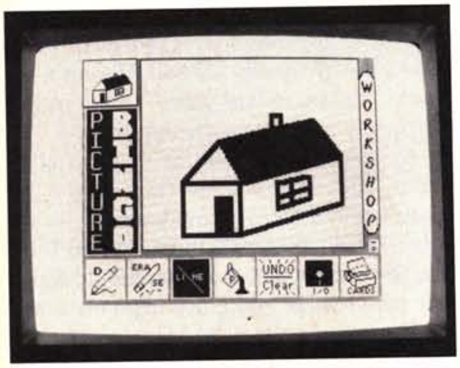
Picture Bingo

Picture Bingo is a clever combination of game and graphics in a program written for the CoCo 3. It requires a disk drive, a mouse or joystick, and a printer. If you have a Radio Shack Speech/Sound Cartridge, the program even talks!

The rules of play are just like regular bingo, except picture cards are used instead of the traditional bingo cards. As the names of the pictures are called out (either by the Speech/Sound Cartridge or a human), the players mark (or cover up) the picture squares on their cards. Just like regular bingo, the center square is a FREE square. Any one of many bingo games can be played. Games include straight Bingo, Four Corners, Postage Stamp, Big X and many others.

I believe one of the most valuable uses of *Picture Bingo* is for educational purposes. The program teaches students how to match the names of items with their associated pictures. It could also be very useful for students learning a foreign language, since the pictures could be named in the language being studied.

Picture Bingo provides not only the actual game playing, but a graphics feature as well. If you select the Workshop option from the Main menu, you are presented with a graphics-screen editor featuring icons for generating your own customized pictures to be used on bingo cards. With your joystick or mouse, you can select icons representing a pencil, eraser, lines, paint, undo/clear, and disk operations. The larger screen area is used to create your picture in a magnified, "large-pixel" format. The upper-left corner of the screen displays the actual picture, in the same size used on the bingo cards, as you create it. Use the various pencil, lines and paint icons to create your picture and save it to disk. You can select See Index to see the names of the pictures already on the disk to avoid using a name more than once. The program comes with 25 pictures already on the disk to allow play right out of the box. A *Copier* program on the disk creates disks that can hold up to 50 pictures.



A *Test Say* program is also included so you can hear how words sound with the Speech/Sound Cartridge installed.

Picture Bingo is a very nice product. Not only does it provide an interesting variation of a popular game, but an educational tool as well. The graphics are good, but color is supported only on a composite monitor. An easy-to-read eight-page instruction booklet is included.

(E.Z. Friendly, 118 Corlies Avenue, Poughkeepsie, NY 12601; $19.95, $1.50 S/H)

— Jerry Semones

Home Help CoCo 1, 2 & 3

Bankman

Bankman Checkbook Keeper is a program used to keep a running record of your checkbook transactions using any Color Computer with at least 32K, one disk drive and a printer. You must enter `WIDTH 32` before running the program on a CoCo 3. Bankman helps you reconcile your checkbook, analyze expenses, and keep a record (on disk or paper) of your checks and deposits. The program allows approximately 60 deposits and more than 500 checks to be entered and analyzed. When the computer's memory is full, the program automatically drops approximately 20 percent of the previous entries to make room for new ones. The totals for these entries, however, are still available to the user.

Bankman Checkbook Keeper includes a 12-page manual and sample data. It also includes a balance-sheet printout created using the manual's sample data.

Before you begin, put your checks and deposits in order either by date or numerically. *Bankman Checkbook Keeper* does not sort, so the way they are entered is the way they are stored and printed.

A configuration program, `CONFIG.BAS`, is included on the disk. When you run it, you are asked for the number of disk drives you have and your printer baud rate. This information is saved to disk and referenced each time the program is run. There is an error in Line 60 of the program. However, it is easily fixed if you know a little about BASIC. *Bankman* then loads automatically. You are prompted for the current date, which is used as the filename. You are presented with the Main menu, which offers several choices including Enter Checkbook Data, View/Edit Deposits, View/Edit Checks, Summarize Checking Activity, Print, Save, Reconcile, and Analyze.

After you use option A (Enter Checkbook Data) from the Main menu, the program automatically goes to option C so you can enter your deposits. This is followed by option D (for checks). However, these options can also be chosen separately from the Main menu. Onscreen prompts guide you while you are entering your data. The running balance is displayed onscreen. Enter the deposits, followed by the checks. You can add new checks or deposits using menu options C and D. When entering information, it's important to give each check and deposit a number since it is by these numbers that each one is stored. When you are editing, you can give a description of the item, but when reconciling, you need the number.

The View option under Menu Option A does not allow for the input of the deposit number to begin the list as is stated in the manual. For example, I chose Option A from the Main menu and then pressed V to view my entered deposits. The program started at Number 1 and continued through Number 61, with most entries containing zeros and no payee. Next, the screen read, "Error Number 8. Press ENTER and try again."

When you are editing an entry, the program doesn't display the information as it is stored in memory. Editing would be easier if you could see the information before changing it. If you are editing a deposit and then ask to view all deposits, the program displays the list beginning with the corrected entry.

The Full Memory option can be toggled on or off. Although I failed to make this option work, it is used to review the results of previous sessions. Other Main menu options are as follows: Option E provides a summary of the number of checks and deposits, along with the total amounts of each. Option F prints a balance sheet of all, or part, of the entered checks and deposits.

Option G saves the data file to disk using the previously entered date as the filename. Option H reads and displays a directory, then asks for the filename. Option I lets you reconcile your account. Just enter your outstanding checks and deposits. A balance is computed, which is then compared to your checking account summary balance. If the difference is not zero, the program helps you find the mistake. You are asked to have your printer turned on when this is chosen. The instructions in the manual are out of order for this selection. Your bank and computer balances must be entered before your outstanding checks.

> ***Bankman Checkbook Keeper* is a program used to keep a running record of your checkbook transactions using any Color Computer with at least 32K, one disk drive and a printer.**

Use the Analyze option to determine how much you have spent for a particular account. All output is sent to the printer. To use this option, checks and deposits must be entered in a standardized manner. For example, to view all checks written to THE RAINBOW you can't just enter RAINBOW. The input must exactly match the name of the entry.

Option K clears CoCo's memory without rebooting. There is verification first.

When you press L to end the session, there is no Are You Sure? or similar prompt before the program does a cold start back to BASIC.

The BREAK key has been disabled. Pressing Reset on my CoCo 3 also forced a cold start.

On printouts, the program should use `PRINT USING` to get complete dollars and cents, rather than just the significant digits. If an amount is $78.20, only 78.2 appears on screen. Also, I accidentally entered $17.254 rather than $17.25 for a check. My balance reported $2864.094 — three digits after the decimal point. There is also no way to stop the listing of all checks and deposits.

If you need help balancing or reconciling your checkbook, consider *Bankman Checkbook Keeper*. However, at $39.95, it seems a little high-priced when compared to similar offerings.

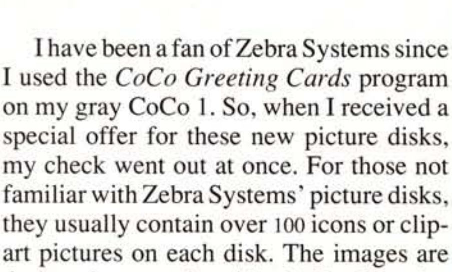
(The Trading Post, P.O. Box 3453, Carbondale, IL 62902-3453; $39.95)

— Lee Deuell

Graphics CoCo 1, 2 & 3

Picture Disks #5 & #6

I have been a fan of Zebra Systems since I used the *CoCo Greeting Cards* program on my gray CoCo 1. So, when I received a special offer for these new picture disks, my check went out at once. For those not familiar with Zebra Systems' picture disks, they usually contain over 100 icons or clip-art pictures on each disk. The images are designed to work with *CoCo Greeting Cards*, *CoCo Graphics Designer*, *CoCo Graphics Designer Plus* and *Label Designer* (all from Zebra Systems). Also included are utilities to transfer them to other formats for use with *CoCo Max III*, *Max 10*, and *CoCo Max II*. In short, these pieces of clip art can be used with just about any Color Computer graphics program. These latest offerings are up to Zebra Systems' usual high standards and are well worth getting.



Picture Disk #5 Zodiac Signs, Hobbies, Vehicles, and Miscellaneous.

The utilities on each disk are excellent and very user-friendly. I do, however, have three minor criticisms. First, each disk has a code in its utilities and you must use the utilities on that disk to process the files on that disk. As supplied, you cannot use the utilities on one disk with files on other Zebra disks. While this is a commendable anti-piracy approach, for those of us who own and use the entire series this is an inconvenience. Bypassing this protection is not impossible if you are reasonably familiar with Disk BASIC. Second, the more extensive graphics editor capability of the older *CoCo Graphics Designer* is not present. Since these utilities allow you to both import and export clip art between the earlier and later Zebra series, I strongly recommend buying a used copy of the earlier version if you can find it (for example, from CoCoPRO!). You could then modify these icons and add to them as you want. My third minor gripe is that no program is supplied to rearrange these icons between the files. This point appears minor until you get over a thousand files or so. Then, such a program becomes important.

However, when the newer Zebra *CoCo Graphics Designer Plus* (CGDP) picture disks came out, I realized the CoCo competes with *PrintShop* for MS-DOS machines. These disks provide many high-quality icons that work well with all the programs they claim to fit.

As a side issue, the current *Disk #1* should not be confused with Zebra's *Border Disk #1* or with the *Picture Disk #1* sold many years ago with the older version. The original *Disk #1* has long been unavailable. Anyway, their latest additional products include *Disk #1*, *Disk #5* and *Disk #6*. *Disk #1* came with my three-for-the-price-of-two buy, but is not the subject of this review. The latter two disks are devoted to the wider-format, double-width icons. *Disk #5* contains 60 such icons, and *Disk #6* contains 50.

Disk #5 contains a number of hobby and sport clip-art images such as coins, stamps, chess pieces, skiers, and people fishing. *Disk #5* also contains more variants on autos and trucks than I ever imagined, as well as other vehicles such as battleships, tanks, planes and other more futuristic craft. One file is devoted to the 12 signs of the zodiac and is well-executed. There are also four double-width blank spaces provided, which supports my reason for considering additional utilities to add users' creations and allow relocating items within files.

Disk #6 contains outline maps of all 50 states. The 28 blank icons (14 if used in the double-width form) provide space for the missing Canadian provinces, Puerto Rico, and the District of Columbia, should someone get creative and place them on a BBS. (And remember that Washington, D.C., is not diamond shaped — one corner was gouged out of the diamond when the city of Alexandria was returned to Virginia!)

The halves of these double-width icons should be placed adjacent to each other. This works quite well. I tried samples from all files present in all sizes on various Zebra products. All the icons tested lined up as expected. I had no trouble of any kind. They also work with Colorware products.

The artwork is good, the concept works,

and the results are useful. I'm glad I purchased these picture disks.

(Zebra Systems, Inc., 121 S. Burrowes St., State College, PA 16801; $14.95 for each disk, plus $3 S/H)

— H. Larry Elman

Game CoCo 3

Honor Quest

It seems that Valkyrie Software, the inventor of the *Honor Quest* adventure game for the CoCo 3 with 128K and a disk drive, is properly named. While attempting to wend my way through the game, I kept going to Valhalla with alarming consistency. In technical terms, this is called dying early and often. For those of you who missed class yesterday, Valhalla was the hall in Norse mythology where Odin welcomed fallen heroes. And the Valkyries were the ladies who conducted these fallen heroes to Valhalla.

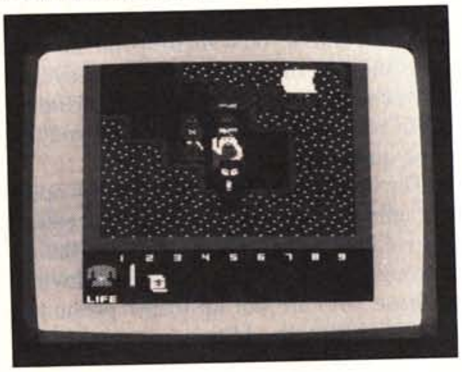
Believe me, the programmers who devised *Honor Quest* are no ladies. I'm not sure they should be called gentlemen, either. These people, who must have graduated from the Marquis de Sade School of Adventure Game Programming, have concocted a game to test your skills of both maneuvering and riddle solving.

The game comes with a program disk, a data disk, and a piece of paper they laughingly call a hint sheet. A note at the bottom of the hint sheet urges players not to follow the directions on the sheet since there is much more to the game than can be learned from just reading about it. This is a little like television programs that warn viewers not to attempt the show's dangerous feats at home, after showing someone setting fire to a courthouse by packing it full of Fourth of July sparklers and zucchini muffins.

Well, you'll have to attempt this dangerous feat at home if you buy this game. You better be an experienced adventure game player, though — a player combining the traits of Indiana Jones, Han Solo, Batman, and Groucho Marx. Yes, Groucho Marx. You'll need a sense of humor about the fifth time you see the message "All the strength drains from your limbs as you pass out," and you awaken in a strange place.

Strange place? Big understatement! This must be the Underworld, which is inhabited by dark yellow-eyed demons and a blonde in a bikini. You must first battle demons with your sword, which looks and sounds a bit like a *Star Wars* light saber. You can then talk with the blonde. She offers you the choice of starting the game over or answering her riddle to return to the land of the living.

In either case you end up in the dark and gloomy woods approaching Sir Paladin's fire, which is surrounded by various beasties with glowing eyes. Sir Paladin is not exactly rocket-scientist material. He and his two unmerry men are supposed to be fleeing the dreaded Druids. And to conceal themselves they have built a roaring fire.



Apparently it is here that you can also decide whether to play the game strictly as an arcade game, bravely battling beasties, or as an adventure game. By directing Steele (your character's name, with no apparent relation to the television private eye) at Sir Paladin and pushing T, you can speak with him. You can also speak with 40 of the other characters of this hostile world, provided they don't disassemble you first.

As with other adventure games, you are the lone hero who must proceed to a final

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destination. On the way you must fight various baddies and collect seemingly useless stuff (which does have a purpose—eventually) to carry around and use to enter certain places, or heal yourself just before the Valkyries come to get you.

There is a game-save option, which they recommend using before entering the Dark Castle. Har! You'd better use it more often than that, unless you want to spend the next three months of your life being recycled between Sir Paladin's fire and the Underworld where the same blonde asks you the same question.

The instructions are sketchy, in my opinion, unless you are an experienced veteran of adventure games. The instructions should thoroughly explain the game for the novice, or those who are not up to the presumed level of ability. In addition, my copy of the instructions were so light that some portions were very difficult to read.

Even though the graphics appear a little blocky at times, they are imaginative and varied. Since the game is supposedly designed to be more of an arcade game than an adventure, the veteran player can probably solve the riddles and puzzles easily, provided they can live long enough. Remember to frequently refer to the comments about saving the game.

This game is about frustration and grim reality. Even though your heart is pure, your strength isn't always high. There *are* times when the dragon wins, by George. For older players this game serves as a reminder of these grim facts. For younger players the game is a warning of things to come.

Someone once said that you can simulate the "boating experience" by standing in a cold shower and tearing up hundred dollar bills. Well, one way to describe the difficulties of success with *Honor Quest* is to imagine playing Russian roulette while tap dancing blindfolded in a mine field. Unless you combine Gregory Hines, one of the brothers Karamazov, an explosive-ordnance disposal technician and Houdini, your chances of survival are somewhere between slim and none.

If you're looking for a challenge where every step may be your last, while figuring out who is what and what is who, this is the game for you. If you'd rather play a new computer game instead of pounding yourself on the head with a rubber mallet, this is also the game for you.

(Valkyrie Software, 37 Peter Bush Drive, Monroe, NY 10950; 914-783-7636; $27.95, plus $2 S/H)

— John M. Hebert

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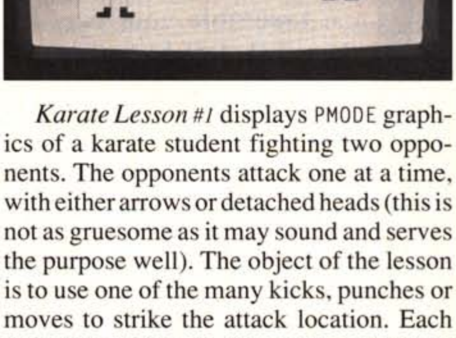
Graphics	CoCo 1, 2 & 3

DSDISK #1

DSDISK #1 is the first disk in a series of shareware programs released by David Sham. Included on the disk are five programs: *Karate Lesson #1*, *3D Function Plot*, *3D Animation Demos 1 & 2*, and *CoCo 2 Bouncing Ball Demo*. These programs require a CoCo with 32K; most require a disk drive.



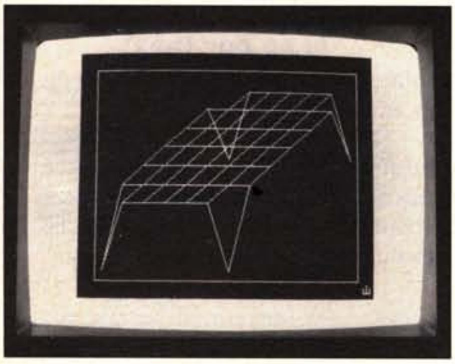
Karate Lesson #1 displays `PMODE` graphics of a karate student fighting two opponents. The opponents attack one at a time, with either arrows or detached heads (this is not as gruesome as it may sound and serves the purpose well). The object of the lesson is to use one of the many kicks, punches or moves to strike the attack location. Each defensive option is displayed on a menu screen and can be activated by a keystroke. From the menu you can start a lesson, view a demonstration or quit.

The demonstration familiarizes you with the 10 possible attack positions and the appropriate defensive counter. In an actual lesson you receive points for quickness, with 11 points being the highest possible. Slower responses reduce the reward points and wrong defensive counters result in negative points.

DSDISK #1 is the first disk in a series of shareware programs released by David Sham. Included on the disk are five programs.

The opponents' quirky movements might be clues to which attack is coming, so watch them closely. This is a fun program and is for those with quick reflexes. Obtaining a score higher than 100 is tough, but not impossible.

The second program, *Plot3D*, flips through eight `PMODE` pages stored in memory to create a 3-D animation effect. The demonstration cycles through two animation sequences. The first sequence is a rectangular grid that rises and lowers while its corners fold. The second demo resembles a parachute opening and closing.



The goal of *Plot3D* is to show how to plot 3-D functions. The listing for this BASIC program is very short and provides novices a base for testing other functions, variables and data.

The next program, *3D Animation Demo #1*, combines the two animation sequences of *Plot3D* and creates a smooth moving figure. The visual effect is interesting and reminded me of the movements of transformer toys. Adjustments can be made to change the number of cycles, forward speed and backward speed. The CoCo 3 double-speed poke can also be set.

3D Animation Demo #2 displays a figure that rotates on three different axes. The animation is smooth and the same settings options as in Demo #1 are given. Both 3-D demo programs are written in machine language and include BASIC loaders.

The last program is the *Bouncing Ball Demo* written in BASIC. A striped ball spins and bounces according to the variable settings you enter. The author states this program will not work properly with the disk controller connected. To run this program from disk, you'll have to use the *Diskoff* program published in THE RAINBOW (July 1988 and December 1988). You can save the program to tape and disconnect the disk controller if you do not have *Diskoff*.

As a reminder, these programs are shareware. The author requests a $12 registration fee.

(Mr. David Sham, 1155 E. 33rd Rd. Ave., Vancouver, BC V5V 3B4, Canada; $12 U.S., plus $3 S/H)

— Jamie Hensen

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Received and Certified

The following products have recently been received by THE RAINBOW, examined by our magazine staff and issued the Rainbow Seal of Certification, your assurance that we have seen the product and have ascertained that it is what it purports to be.

Picture Disk #5, clip-art graphics designed by David Oxenreider and Avram Grumer. This disk contains four picture collections: Hobbies, Astrol, Vehicles, and Mixed. Each collection contains 16 pictures for a total of 64 pictures on the disk. Pictures files are in the *CoCo Graphics Designer* (*Plus*) format, and the disk includes conversion utilities to generate *CoCo Max II*, *CoCo Max III* and *Max-10* format disks. *Zebra Systems, Inc., 121 S. Burrowes Street, State College, PA 16801; 814-237-2652; $14.95, plus $3 S/H.*

Picture Disk #6, more clip-art graphics. The disk contains pictures of all 50 U.S. states. Each image is scaled to fit within the 64-by-56-pixel, two-picture area that two standard Zebra graphics pictures represent. The states are presented in alphabetical order in four picture collections. The disk has *CoCo Graphics Designer* (*Plus*) files on it, as well as conversion utilities to generate *CoCo Max II*, *CoCo Max III* and *Max-10* format disks. *Zebra Systems, Inc., 121 S. Burrowes Street, State College, PA 16801; 814-237-2652; $14.95, plus $3 S/H.*

Kyum-Gai: to be Ninja (OS-9 Version), a martial-arts arcade game featuring 320-by-200, 16-color graphics and digitized sound effects. Requires 512K (or minimum 256K) CoCo 3 and OS-9 Level II. *Sundog Systems, P.O. Box 766, Manassas, VA 22111; 703-330-8989; $29.95, plus $2.50 S/H.*

DSDISK #3, a disk containing three programs written by David Sham: `MAC3.BAS`, a Mac-to-`HSCREEN2` transfer utility (size = 1/3, requires 512K and a RAM disk); `MAC3S.128`, a 128K version of `MAC3.BAS` (requires a CoCo 3 and a disk drive); and `H2EDIT.BAS`, an `HSCREEN2` editor (requires a CoCo 3 and a disk drive). One `.CM3` and five `.MAC` pictures are included on disk for use as demos and testing the programs. *Mr. David Sham, 1155 E. 33rd Ave., Vancouver, BC V5V 3B4, Canada; $22 U.S., plus $3 S/H.*

KJV on Disk #19, Psalms chapters 1-87 from the King James Version of the Bible, in ASCII files for the CoCo 1, 2 and 3. A word processor or text editor is recommended for viewing the files. Requires at least 32K and one disk drive. *BDS Software, P.O. Box 485, Glenview, IL 60025-0485; $3.*

KJV on Disk #20, Psalms chapters 88-150 from the King James Version of the Bible, in ASCII files for the CoCo 1, 2 and 3. A word processor or text editor is recommended for viewing the files. Requires at least 32K and one disk drive. *BDS Software, P.O. Box 485, Glenview, IL 60025-0485; $3.*

D10 Fonts for *Max-10*, document fonts for all versions of *Max-10*. These fonts have a point size between 8 and 18. Included are fonts for Times Roman, Peignot, Block, Venice, Display, Woodhaven, Digital, Writing, and Dingbats. *Max-10* is required to use this program. *Coless Computer Design, 1917 Madera St. #8, Waukesha, WI 53186; $14.95, plus $3 S/H.*

The *Seal of Certification* is open to all manufacturers of products for the Tandy Color Computer, regardless of whether they advertise in THE RAINBOW.

By awarding a *Seal*, the magazine certifies the program does *exist* — that we have examined it and have a sample copy — but this *does not* constitute any guarantee of satisfaction. As soon as possible, these hardware or software items will be forwarded to THE RAINBOW reviewers for evaluation.

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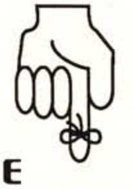

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Reviewer Information

In order to continue to bring Tandy Color Computer users all the best information about new hardware and software products each month, we are constantly looking for new people to join our independent review staff. Therefore, we invite you to join THE RAINBOW's elite fleet of reviewers.

You read THE RAINBOW because you love your Color Computer, so if you want a creative outlet and a chance to examine quality hardware and software, with your observations published nationwide, we want to hear from you.

Send us a cover letter with your name, address, occupation, list of equipment, areas of general interests, and a sample review of a CoCo product you are currenly using. We look forward to your response. After all, we already see you have the best taste in computers.

Reply to:

Reviews Editor
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The Falsoft Building
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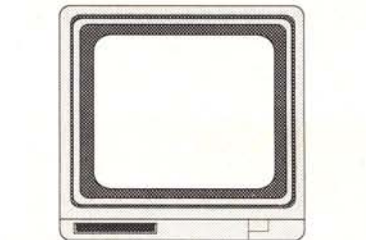
Prospect, KY 40059



Continued from Page 6

Getting the Word

Editor:

I would like some information on word processors for my Tandy Color Computer. I have a 64K Color Computer 2 with a disk drive. Is there any word processor available for this computer? If so, please send me the information. Thank you.

Keith Wood
P.O. Box 751
Pine Mountain, GA 31822

Check the SD Enterprises ad in this issue for information about VIP writer.

Ghana Bwana Meets the CoCo 3

Editor:

I recently bought *Ghana Bwana* from my local Radio Shack, but it will not load on my CoCo 3. All I get is the title screen that tells me the program is loading. But nothing happens. Does anyone know how to get the program to run?

David Sekirka
1687 N. Michigan Street, Lot 106
Plymouth, IN 46563

Steve Bjork, author of Ghana Bwana, *uploaded a patch to Delphi just after the CoCo 3 was introduced. We contacted Steve at SRB Software, and he gave us permission to reprint the patch here, as an aid to our readers without modems. Following is the program listing for the patch:*

The Listing: `NEWBOOT`

```
10 'NEW PROGRAM BOOT FOR GHANA B
WANA, PITFALL II, DESERT RIDER,
& ONE ON ONE.
20 'THIS PROGRAM WILL GIVE YOU F
ULL COLOR ON A COLOR COMPUTER 3
WHEN USING A RGB MONITOR.
30 'THIS PROGRAM WILL ALSO FIX T
HE BUG IN GHANA BWANA ON THE COL
OR COMPUTER 3.
40 CLEAR 50,&H3FFE
50 P=PEEK(&H3FFF)
60 X=&H7FFF:POKE X,165
70 POKE X,255-PEEK(X)
80 IF PEEK(X)<>90 THEN 100
90 IF P=PEEK(&H3FFF) THEN 110
100 CLS:PRINT"64K IS NEEDED FOR
THIS PROGRAM"
110 CLEAR 500,&H7FFF
120 FOR I=0 TO 70
130 READ A$
140 POKE &H5000+I,VAL("&H"+A$)
150 NEXT I:WIDTH 32
160 DSKI$0,34,4,A$,B$:SUM=0:FOR
X=1 TO 128:SUM=SUM+ASC(MID$(A$,X
,1))+ASC(MID$(B$,X,1)):NEXT X
170 IF SUM=20423 THEN INPUT"REMO
VE WRITE TAB FROM DISK AND  PRES
S ENTER.";Q$:MID$(A$,106,1)=CHR$
(254):MID$(A$,122,1)=CHR$(254):D
SKO$0,34,4,A$,B$:GOTO 160
180 READ S,A,B,C,D:IF S=0 THEN 2
80 ELSE IF S<>SUM THEN 180
190 POKE &HFFD8,0:PRINT "ARE YOU
 USING AN RGB MONITOR?   (Y/N)"
200 Q$=INKEY$:IF Q$<>"Y" AND Q$<
>"N" THEN 200
210 IF Q$="N" THEN 280
220 PALETTE 0,A:PALETTE 4,A
230 PALETTE 1,B:PALETTE 5,B
240 PALETTE 2,C:PALETTE 6,C
250 PALETTE 3,D:PALETTE 7,D
260 PRINT "PLEASE HOLD THE CLEAR
 KEY UNTIL THE GAME IS BOOTED."
270 IF INKEY$<>CHR$(12) THEN 270
280 EXEC &H5000
290 DATA 86,22,8E,26,00,8D,0D
300 DATA FC,26,00,10,83,4F,53
310 DATA 26,03,7E,26,02,39,34
320 DATA 20,10,BE,C0,06,A7,22
330 DATA 86,02,A7,A4,6F,21,6F
340 DATA 23,6C,23,AF,24,10,BE
350 DATA C0,06,A6,23,81,13,27
360 DATA 12,AD,9F,C0,04,4D,27
370 DATA 06,6C,23,6C,24,20,E9
380 DATA 7F,FF,40,35,A0,4F,20
390 DATA F8
400 DATA 22438,63,0,9,36
410 DATA 20651,63,36,9,0
420 DATA 22631,0,9,36,63
430 DATA 65280,63,36,9,0
440 DATA 0,0,0,0,0
```

THE RAINBOW welcomes letters to the editor. Mail should be addressed to: Letters to Rainbow, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. Letters should include the writer's full name and address. Letters may be edited for purposes of clarity or to conserve space.

Letters to the editor may also be sent to us through our Delphi CoCo SIG. From the CoCo SIG> prompt, type `RAI` to take you into the Rainbow Magazine Services area of the SIG. At the RAINBOW> prompt, type `LET` to reach the LETTERS> prompt and then select Letters for Publication. Be sure to include your complete name and address.

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Intercom

An important link in the CoCo community is its ability to communicate with fellow users. If questions arise, a fresh source of information can be invaluable. We here at THE RAINBOW have decided to create "Intercom," an information exchange point for Pen Pals, CoCo Clubs and BBSs.

If you would like a Pen Pal or are running a CoCo Club or BBS, send us a letter including the information listed here to: The Rainbow Intercom, P.O. Box 385, Prospect, KY 40059.

Only those parties who have signed our non-piracy "agreement form" appear in listings of Intercom. Also, please notify us if you want to add or delete any names on this list.

PEN PALS

✍ I'm a third grade teacher and ham radio operator (KA1UVE). I love my six CoCo 1s and 2s — upgrading, scavenging, software, ROM packs, etc. I also like simple hardware project building. I have nothing more than 64K RAM, no CoCo 3s, which I think spelled the end of the golden age of CoCo.

I use CoCos every day in my classroom and would like to hear from others with similar interests.

Charles Scanlon
One Hoskins Rd., Apt. 8A6
Simsbury, CT 06070

✍ I'm 23 years old and have a CoCo 2, a disk drive and *JDOS*. I enjoy playing adventure games as well as creating them. I'm looking for pen pals with information on games and other areas of CoCo programming. All letters are welcome and will be answered.

Johnny Tucker
Box 612
Fairland, OK 74343

✍ I'm interested in finding pen pals who use MIDI with their CoCos. I use my 512K CoCo 3 with my Yamaha keyboards. I work with both *Lyra* and *UltiMusE III*. There is only one other person in my area that uses MIDI and I would like to find other people of similar interest. I may be able to help with MIDI problems pertaining to the CoCo, so please write.

Michael Jones
281 Lakeview Drive
Mobile, AL 36695

CoCo CLUBS

ARIZONA

☎ Tucson Color Computer Club, Bruce Smith, 3030 Mustang Drive, Tucson, 85708, (602) 747-7859

CALIFORNIA

☎ Citrus Color Computer Club, Orville Beaver, P.O. Box 6991, San Bernardino, 92412-6991, (714) 685-6334

☎ Color America Users Group, Jack W. Eizenga, 3811 N. Foster Ave., Baldwin Park, 91706-3912, (818) 960-8010

☎ Marysville/Yuba City Area CoCo Club, Jim Vestal, P.O. Box 5126, Marysville, 95901, (916) 742-5499

COLORADO

☎ Colorado Springs Color Computer Club, Bud Ward, 1118 Claiborne Road, Colorado Springs, 80906-5513, (719) 392-8268

CONNECTICUT

☎ Connecticut CoConut Connection, Charles Joseph Scanlon, 1 Hoskins Rd. Apt. 8A6, Simsbury, 06070, (203) 651-8134

☎ South Eastern Connecticut Color Computer Users Group, Larry Donovan, 25 Stony Brook Road, Stonington, 06378, (203) 535-4211

FLORIDA

☎ Cross-Country Color Computer Club, Tom Tittle, 860 Gardenia Drive, Royal Palm Beach, 33411, (407) 798-3726

GEORGIA

☎ Atlanta Computer Society, Inc., Alan R. Dages, 4290 Bells Ferry Road, Suite 10639, Kennesaw, 30144, (404) 469-5111 voice, (404) 636-2991 modem

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IOWA

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☎ Mid Iowa CoCo, Terry Simons, 1328 48th, Des Moines, 50311, (515) 279-2576

KANSAS

☎ The Kansas City Color Computer Users Group, Gay Crawford, 1601 Kiowa Drive, Olathe, 66062, (913) 764-9413

KENTUCKY

☎ Hardin County Color Computer Club, Paul Urbahns, 2887 Republic Ave., Radcliff, 40160, (502) 351-4757

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☎ The CoCo SIG, Christopher Mayeux, 20 Gibbs Drive, Chalmette, 70043, (504) 277-6880 voice, (504) 277-5135 modem

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☎ Arkade, John M. Beck, 3513 Terrace Drive #D, Suitland, 20746, (301) 423-8418

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☎ TRS-80 Computing Club, David McNally, 65 Oak Rd., Canton, 02021-2605, (617) 828-7749

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☎ Central Mississippi Color Computer Society, Boisy G. Pitre, 6011 I-55 North, Jackson, 39213, (601) 956-9377

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☎ CoCoNuts User Group, Clyde Lloyd, 2116 N. Columbia, Springfield, 65803, (417) 866-8738

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☎ Twin Tiers CoCo Club, William Cecchini, 319 Irvine Place, Elmira, 14901, (607) 734-0065

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☎ Norca Users Group, Matthew Royal, Route 21 Box 906, Fayetteville, 28304, (919) 484-1230

OHIO

☎ The Columbus and Central Ohio Color Computer Club, Richard Heber, 546 Woodside Drive S.W., Pataskala, 43062, (614) 927-3357

PENNSYLVANIA

☎ Cumberland Valley Users Group, Thomas Martin, 9085 Newburg Road, Newburg, 17240, (717) 423-5525

☎ Pittsburgh Color Group, Ralph Marting, 309 Frazier Drive, Pittsburgh, 15235, (412) 823-7607

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☎ New England "CoCoNuts" Color Computer Club, Arthur J. Mendonca, P.O. Box 28106 North Station, Providence, 02908, (401) 272-5096 (Sig3)

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☎ Spartanburg CoCo Club, Jesse W. Parris, 152 Bon Air Ave., Spartanburg, 29303, (803) 573-9881

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☎ Empire Area Color Computer Users Group of South Dakota, Carl Holt, P.O. Box 395, Brandon, 57005, (605) 582-3862

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☎ The Codis CoCo Symphony, William C. Garretson, 2902 Harvard St., Irving, 75062, (214) 570-0823

☎ Mid Cities TRS-80 Users Group, Rob Yoder, P.O. Box 171566, Arlington, 76003, (817) 535-7931

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☎ Richmond Area Color Computer Organization, William T. Mays Jr., 6003 Westbourne Drive, Richmond, 23230, (804) 282-7778

☎ Southwestern Virginia Color Computer Club, Ricky Sutphin, Route 1 Box 20, Henry, 24102, (703) 365-2018

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☎ Port Orchard CoCo Club, Donald Zimmerman, 3046 Banner Rd. SE, Port Orchard, 98366-8810, (206) 871-6535

☎ Spokane Color Computer Club, Richard Baysinger, W. 2217 Sanson, Spokane, 99205, (509) 326-2793, BBS (509) 325-6787

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☎ Huntington Area Color Computer Symposium, Jim Bush, P.O. Box 391, Lesage, 25537-0391, (304) 736-5314

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☎ Australian National OS-9 Users Group, Gordon Bentzen, C/- 8 Odin Street, Sunnybank, Queensland, 4109, (07) 344-3881

☎ Brisbane Southwest Colour Computer Users Group, Bob Devries, 21 Virgo St., Inala, Queensland, 4077, (07) 372-7816

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☎ Vancouver Color Computer Club (VC3), Jordan J. Dobrikin, P.O. Box 76734, Postal Station 5, British Columbia, V5R 5S7, (604) 420-6081

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Colorado Springs	The Time Safari	(719) 635-7228	300/1200-N-8-1	David Vallier
Connecticut				
Waterbury	Applause BBS	(203) 754-9598	300/1200/2400-N-8-1	Carmen Izzi, Jr.
Florida				
Cocoa Beach	KB Enterprises' CEBBS[1]	(407) 799-3282	300/1200-N-8-1	Kevin Berner
Hawaii				
Ft. Shafter	CoCo'Nuts BBS Service	(808) 845-7054	300/1200/2400-N-8-1	Tommie Taylor
Illinois				
Carpentersville	The Pinball Haven BBS	(708) 428-8445	300/1200/2400-N-8-1	Jeffrey R. Chapin
La Grange Park	S & V BBS	(708) 352-0948	300/1200/2400-N-8-1	Paul Jerkatis
Kansas				
Beloit	Kansas Konnektion BBS[2]	(913) 738-5613	300/1200-N-8-1	Gary N. McCarty
Louisiana				
Harvey	The Node 3	(504) 347-4320	300/2400-N-8-1	Gene Clifton
Michigan				
Lansing	Benchboard BBS	(517) 394-2447	300/1200/2400-N-8-1	John Evans
Taylor	J & L's CoCo Corner	(313) 292-4713	300/1200/2400-N-8-1	Jim Snider
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Wappingers Falls	The Dutchess CoCo	(914) 838-1261	300/1200/2400-N-8-1	Chris Serino
North Dakota				
Minot AFB	The 9-Line BBS	(701) 727-6826	300/1200-N-8-1	David Hensley
Ohio				
Reynoldsburg	East Side Connection CEBBS	(614) 755-2492	300/1200/2400-N-8-1	John L. Wilkerson
Oklahoma				
Tecumseh	Pat BBS[3]	(405) 598-5082	300-N-8-1	Pat Aldridge
Pennsylvania				
Conshohocken	Charlie's Help Line	(215) 825-3226	300/1200-N-8-1 or N-7-1	Charles DiMartino
Johnstown	CoCo Electronic BBS[4]	(814) 535-1497	300/1200/2400-N-8-1	Albert Baldish
Rhode Island				
Central Falls	The Weather Connection II BBS	(401) 728-8709	300/1200/2400-N-8-1	Eric Chew
Virginia				
Fall Mills	Clem's Corner BBS[5]	(703) 322-4053	300/1200-N-8-1	Richard Douglas Bailey
Richmond	Tree House BBS	(804) 744-0157	300/1200/2400-N-8-1	Doug James
Canada				
Cornwall, Ontario	4C's BBS	(613) 936-0823	300/1200/2400-N-8-1	Mike Lebrun

Notes:
[1] KB Enterprises' CEBBS is up from 5 p.m. to 9 a.m. seven days a week (EST).
[2] Kansas Konnektion BBS is up from 10 p.m. to 7 a.m.
[3] Pat BBS is up 5 p.m. to 9 p.m. weekdays and 10 a.m. to 10 p.m. weekends. This new BBS is counting on you for uploads.
[4] CoCo Electronic BBS is up 8 p.m. to 6 a.m. seven days a week.
[5] Clem's Corner BBS is up from 6 p.m. to 11 p.m. seven days a week.

Pyramid

by George Quellhorst

Stacking the odds with Solitaire

Pyramid is a very addictive, easy-to-play solitaire game. Program requirements include a Color Computer 3, an RGB monitor and a disk drive. Seven rows of cards are displayed on the screen at the start of the game. The first six rows are upside-down and the last row is displayed face-up. The first row contains one card, the second row has two cards, the third row has three cards, and so on. A total of 28 cards are displayed on the screen, with 24 cards remaining in the deck. The deck is displayed in the top-left corner of the screen. The top card in the deck is shown face-up.

Playing the Game

The object of the game is to move all cards in the pyramid to the deck. The game has been successfully completed when the last card, the top of the pyramid, has been placed on the deck. A card may be moved onto the deck when its value is one greater or one lower than that of the top card in the deck, regardless of the color or suit of the card being moved. For example, a five can be placed on top of either a four or a six; an Ace can be placed on top of a King or a two; and so on.

The program does not allow you to make illegal moves. If you attempt an illegal move, an error beep sounds and the last key pressed is ignored by the computer. A card moved to the deck becomes the new top card until another card is moved up or until you "turn over" the next card in the deck. When a legal move is not available, you must press the up-arrow key to "turn over" the next card in the deck. If the next card does not provide you with a legal move, you must continue "turning over" cards until a legal move becomes available.

When all 24 cards in the deck have been used and there are cards still in the pyramid with no legal moves remaining, the game has reached an unsuccessful completion. A successful completion of the game involves moving all 28 cards to the deck before running out of cards in the deck.

Since the entire game is played with the use of the ENTER and the four arrow keys, the BREAK key is often pressed by mistake. I poked a value of 255 into the keyboard rollover table at location 41598 (Line 5) to disable the BREAK key. Press SHIFT/BREAK or Q to restore the BREAK key to normal operation.

Manipulating the Cursor

The cursor appears as a blinking border around the card being put into play. The cards in the pyramid are numbered (for programming purposes) from one to 28 starting at the top of the pyramid and moving from left to right down the pyramid. Pressing the right-arrow key moves the cursor to the next higher-numbered card being displayed face-up in the pyramid. The left-arrow key moves the cursor to the next lower-numbered card in the pyramid. The cursor will not stop on an empty spot. If a card has been moved to the deck, the cursor skips that "empty" position in the pyramid. The cursor also has a wrap-around feature. If you move the cursor to the right side of the screen with the right arrow, pressing this key once more causes the cursor to move to the left side of the screen.

The Ups and Downs

Pressing the up arrow key turns the next card in the deck over and places it on the top of the deck. If no legal move is available

George Quellhorst has been a CoCo user since the days of 4K. He has two CoCo 2s and a CoCo 3 with an RGB monitor. He enjoys writing programs with his computer equipment. He can be contacted at 63 South State St., Painesville, OH 44077.

after turning over the next card, you must continue to press the up-arrow key until a legal move becomes available. The Cards Remaining Counter, displayed under the deck, keeps a running count of the cards left in the deck.

The down arrow is your "oops" key. Pressing the down arrow key restarts the current game without shuffling the deck. You may use this option when you make a mistake, or if you want to play the same game with a different strategy.

The ENTER Key

Pressing ENTER takes the card situated beneath the cursor and places it on the top of the deck, if the move is legal. You can continue play as long as legal moves remain. When a card in the pyramid is no longer covered by any other card, the computer turns that card face-up.

The Space Bar

Pressing the space bar restarts the game — the deck is shuffled and you get a fresh game. Press Q to stop the program.

Summary

The program "knows" when the deck is empty, cards remain in the pyramid, and no legal moves remain. It informs you of your loss and displays the available options at the bottom of the screen. The program also "knows" if you have won the game and announces this event in a similar manner. The program is very fast since the cards are moved from the pyramid to the deck with `HGET` and `HPUT` commands. The only cards drawn are those being turned over and those produced in the deck when you press the up-arrow key. This game is very addictive. It is almost impossible to stop playing once you start. A lot of luck is needed to win, but a certain amount of strategy is also required since there are many times when three or more legal moves are possible at once.

Feel free to contact me if you have any questions about this game. For a response by mail please include an SASE. Or you may call me at 216-354-3812 from 8 a.m. until 10 p.m. EST. ❑

CoCo 3 Disk

2	38
10	136
19	187
27	35
38	29
44	4
50	134
53	179
60	98
70	109
END	143

The Listing: PYRAMID

```
0 'PYRAMID
** WRITTEN BY GEORGE QUELLHORST
** COPYRIGHT (C) MAY 1991
** BY FALSOFT, INC.
** RAINBOW MAGAZINE
1 DATA 284,0,244,24,324,24,204,4
8,284,48,364,48,164,72,244,72,32
4,72,404,72,124,96,204,96,284,96
,364,96,444,96,84,120,164,120,24
4,120,324,120,404,120,484,120,44
,144,124,144,204,144,284,144,364
,144,444,144,524,144
2 CLEAR1000:RGB:HBUFF1,810:HBUFF
2,810:HBUFF3,810:HBUFF4,810:HBUF
F5,810:SH=1:POKE400,180:EXEC4335
0:POKE&HF80F,0:POKE&HF84F,0:POKE
&HF89C,0:PALETTE0,63:PALETTE1,60
:PALETTE2,0:PALETTE3,36:DIMN$(13
),X(29),F(29),Y(29),CA(52)
3 POKE65497,,:WIDTH80:CLS1:POKE6
5434,63:LOCATE27,11:PRINT"PLEASE
 WAIT DRAWING SCREEN":IFSH=1THEN
LOCATE30,13:PRINT"AND SHUFFLING
CARDS"
4 R=RND(-TIMER):GOSUB50:IFSH=1TH
ENGOSUB55
5 GOSUB43:POKE41598,255:T=25:DE=
29:ONBRKGOTO64
6 'Cursor control.
7 P$=INKEY$
8 HCOLOR2:HDRAW"BM"+STR$(X(T))+"
,"+STR$(Y(T))+A$
9 IFDE=52 ANDMO=1 THENGOSUB70
10 IFP$=CHR$(8)THENT=T-1 ELSEIFP
$=CHR$(9)THENT=T+1 ELSE13
11 IFT=>29THENT=1ELSEIFT=0THENT=
28
12 IFF(T)=0 OR F(T)=2 THEN10ELSE
EXEC
13 IFP$=CHR$(13)THENF(T)=2:GOTO1
9 ELSEIFP$=CHR$(94)THENEXEC:GOTO
37
14 IFP$=CHR$(10) THENSH=0:CA(0)=
AC:GOTO3ELSEIFP$=" "THENSH=1:GOT
O3
15 HCOLOR0:HDRAW"BM"+STR$(X(T))+
",”+STR$(Y(T))+A$
16 IFP$="Q"THEN64
17 GOTO 7
18 ' The enter key.
19 GOSUB59:Q=0:EC=W:TT=T:T=0:GOS
UB59:Q=0:TC=W
20 IFEC-TC=1 OR EC-TC=12 OR TC-E
C=1 OR TC-EC=12 THENT=TT:GOTO22
21 GOSUB65:T=TT:F(T)=1:GOTO7
22 EXEC:H=T:Z=3:GOSUB68:Z=2:GOSU
B67:H=0:Z=3:GOSUB67
23 H=T-1:Z=4:GOSUB68:H=T+1:Z=5:G
OSUB68:CN=T-(Y(T)/24):IFF(1)=2TH
EN74
24 L=CN-1:R=CN:IFY(L)=Y(R)THEN25
ELSEIFX(T)>284THEN28 ELSEIFY(L)<
>Y(R)THEN27
25 H=L:Z=1:GOSUB67:H=R:GOSUB67
26 H=T-1:Z=4:GOSUB67:H=T+1:Z=5:G
OSUB67:GOTO29
27 H=R:Z=1:GOSUB67:H=T+1:Z=5:GOS
UB67:GOTO31
28 H=L:Z=1:GOSUB67:H=T-1:Z=4:GOS
UB67:RS=1:GOTO29
29 IFF(T-1)=2 THENTT=T:T=L:F(L)=
1:BU=2:GOSUB48:GOSUB59:GOSUB57:Q
=0:T=TT
30 IFRS=1THENRS=0:GOTO32
31 IFF(T+1)=2 THENTT=T:T=R:F(R)=
1:BU=2:GOSUB48:GOSUB59:GOSUB57:Q
=0:T=TT
32 CA(0)=CA(T)
33 T=T+1:IFT=>29THENT=1
34 IFF(T)=0ORF(T)=2 THEN33
35 MO=1:GOTO7
36 ' The up-arrow key.
37 IFDE=52 THENGOSUB65:GOTO7
38 TT=T:DE=DE+1:T=DE:X=52:Y=16:H
PUT(X,Y)-(X+67,Y+44),2
39 GOSUB59:HCOLOR2:HDRAW"S4BM52,
16"+A$:T=0:GOSUB57
40 HCOLOR0:HPRINT(9,8),53-DE:HCO
LOR2:HPRINT(9,8),52-DE
41 T=TT:Q=0:CA(0)=W:GOTO7
42 ' Draw Screen.
43 A$="R67D44L67U44":MO=1:F(0)=2
:POKE59065,57:HSCREEN4:POKE59065
,32:HCLS1:HCOLOR2:HDRAW"S4BM20,2
0"+A$:HGET(20,20)-(87,64),1:HCLS
0:HGET(500,20)-(567,64),2
44 T=0:X(0)=52:Y(0)=16:BU=2:GOSU
B48:RESTORE:BU=1:FORT=1TO21:F(T)
=0:READX(T),Y(T):GOSUB48:NEXT:BU
=2:FORT=22TO28:F(T)=1:READX(T),Y
(T):GOSUB48:NEXT
45 HCOLOR2:HPRINT(52,1),"PYRAMID
":HPRINT(59,3),"BY":HPRINT(61,5)
,"GEORGE QUELLHORST":HPRINT(10,8
),"23":HPRINT(6,9),"CARDS LEFT"
46 Q=0:W=0:T=0:GOSUB59:GOSUB57:Q
=0:FORT=22TO28:GOSUB59:GOSUB57:Q
=0:NEXT
47 POKE59108,230:HSCREEN4:POKE59
108,231:POKE65434,63:RETURN
48 HPUT(X(T),Y(T))-(X(T)+67,Y(T)
+44),BU:HCOLOR2:HDRAW"BM"+STR$(X
(T))+","+STR$(Y(T))+A$:RETURN
49 Define variables.
50 N$(1)="BR3R3F3D4LU4H3LG3D4LU4
E3BL2BD5R7":N$(2)="BRR7FD2GL6GD2
R8ULDL8U2ER6EU2HBL6DLU":N$(3)="B
RR7FDGFD2GL7HUBRDFBR5EU2HL3BR3EU
HBL5GDBLUE":N$(4)="BR4R4D4R2L2D3
```

```
LU7BL2G4R6BL7E4"
51 N$(5)="BR9L9D3RU3BD3R7FD2GL7H
URDFBR5EU2H":N$(6)="BR9L8GD5FR7E
U2HL6BLU2EBGBD2BRGD2FR5EU2H":N$(
7)="R9DG6LE6UBL7DLU":N$(8)="BRR7
FDGFD2GL7HU2EHUEBRGDFR5BL5GD2FBR
5EU2HEUH":N$(9)="BRR7FD5GL8BR7EU
2BLEU2HBL5GD2FR5BL5BLHU2E"
52 N$(10)="BR2RD7BR2L5BR2U6GLE2B
R8R7FD5GL7HU5EBRGD5FBR5EU5H":N$(
11)="BR4R5BL2D6GL5HURDFBR3EU6L2"
:N$(12)="R9D7L9U7BRD7BR7U7D6LF2R
2UL2":N$(13)="R2D7LULDRU7LDRBRBD
3E4R2GLG4BEF3R2HLH3"
53 C$(1)="BR4R2F3E3R2F4G8L2H8E4B
L4":C$(2)="BR7R4FRF5G5LGL4HLH5E5
REBR7":C$(3)="BR9RF8G3LH2L2D2FL4
EU2L2G2LH3E8RBR":C$(4)="BR9F4G3R
2E2RF3G3LH2L2D2FL4EU2L2G2LH3E3RF
2R2H3E4BL9":RETURN
54 ' Shuffle the deck.
55 FORT=1TO52:CA(T)=T:NEXT:FORT=
1TO52:R=RND(52):S=CA(R):CA(R)=CA
(T):CA(T)=S:NEXT:SH=0:AC=CA(29):
CA(0)=CA(29):RETURN
56 ' Draw cards on screen.
57 HCOLOR2:HDRAW"S8BM"+STR$(X(T)
+16)+","+STR$(Y(T)+14)+C$(Q):HCO
LORHC:HDRAW"S4BM"+STR$(X(T)+8)+"
,"+STR$(Y(T)+4)+N$(W):HPAINT(X(T
)+34,Y(T)+24),HC,2:RETURN
58 ' Compute suit and value of c
ard.
59 W=CA(T)
60 IFW<=13THENQ=Q+1:GOTO61:ELSEW
=W-13:Q=Q+1:GOTO60
61 IFQ<3THENHC=3ELSEHC=2
62 RETURN
63 ' ONBRKGOTO and Quit.
64 RGB:HSCREEN0:CLS3:POKE65496,.
:ATTR3,2:POKE41598,3:STOP
65 POKE65496,.:POKE400,20:FORD=1
TO10:EXEC:NEXT:POKE65497,.:POKE4
00,180:RETURN
66 'HPUT & HGET cards on screen.
67 HPUT(X(H),Y(H))-(X(H)+67,Y(H)
+44),Z:RETURN
68 HGET(X(H),Y(H))-(X(H)+67,Y(H)
+44),Z:RETURN
69 'Check to see if game is over
. or won.
70 MO=0:TT=T:FORK=1TO28:IFF(K)=1
 THENT=K:GOSUB59:Q=0:TC=W:T=0:GO
SUB59:Q=0:EC=W:T=TT ELSE72
71 IFEC-TC=1 OR EC-TC=12 OR TC-E
C=1 OR TC-EC=12 THENRETURN
72 NEXTK:GOSUB65:HCOLOR2:HPRINT(
12,22),"GAME IS OVER YOU LOST.
PRESS SPACEBAR TO PLAY ANOTHER G
AME":HPRINT(14,23),"PRESS DOWN A
RROW TO PLAY SAME GAME.  PRESS <
Q> TO QUIT"
73 P$=INKEY$:IFP$=" "THENSH=1:GO
TO3ELSEIFP$=CHR$(10)THENSH=0:CA(
0)=AC:GOTO3ELSEIFP$="Q"THEN64ELS
E73
74 HCOLOR3:HPRINT(28,10),"WELL,
YOU FINALLY DID IT.":HPRINT(32,1
2),"YOU WON THE GAME":HPRINT(32,
14),"CONGRATULATIONS !":HPRINT(1
0,20),"PRESS SPACEBAR FOR ANOTHE
R GAME, DOWN ARROW TO PLAY SAME
GAME":HPRINT(32,22),"PRESS <Q> T
O QUIT."
75 PLAY"T2L5;O2BAGDO1DO2ABG":GOT
O73
```

Novices Niche

Game 16K Extended

Space Kamikaze

By T.C. Taulli

Space Kamikaze is a shoot-'em-up arcade game where the object is to destroy as many enemy kamikaze spacecraft as possible. However, your fighter can only withstand five enemy collisions. Some hits are so severe they count as two damage points. Fortunately, it's easy to play this game. Just remember that if you point your joystick up or down, your fighter obeys the order. Also, once you have an enemy locked on target, press the joystick button and your lasers fire. Beware, these kamikazes sometimes evade the laser fire.

The Listing: SPACE

```
1 'SPACE KAMIKAZE
2 'WRITTEN BY T.C. TAULLI
3 'COPYRIGHT (C) APRIL 1991
4 'BY FALSOFT, INC.
5 'RAINBOW MAGAZINE
10 CLEAR 2000:DIM T(200),H(200),
R(200),XX$(40),LA(200):Y$=CHR$(1
28):U=0
20 CLS5
30 DATA161,162,163,165,170,175
40 FOR X=1 TO 6:READ Q(X):NEXT X
50 FOR X=0 TO 10:PRINT@X*32,STRI
NG$(32,128);:NEXTX
60 FOR X=1 TO 32:XX$=XX$+CHR$(Q(
RND(6))):NEXTX
70 PRINT@320,XX$;
80 N$=CHR$(155):B=134
90 PRINT@B,N$;
100 PRINT@384,"HIT(S)";
110 PRINT@448,"DAMAGE";
120 PRINT@416,"SCORE";
130 GOSUB 610
140 FOR X=1 TO 200
150 C=PEEK(65280)
160 IF RND(7)=1 THEN G=G+1:T(G)=
(RND(9)*32)-1
170 FOR Y=1+U TO G
180 C=PEEK(65280)
190 IF T(Y)=0 THEN 420
200 IF H(Y)=7 THEN PRINT@LA(Y),Y
$;:T(Y)=0:U=U+1:GOTO 420
210 IF PEEK(1024+T(Y))=159 THEN
GAME=1
220 PRINT@LA(Y),Y$;:PRINT@T(Y),C
HR$(162);:LA(Y)=T(Y):T(Y)=T(Y)-5
:H(Y)=H(Y)+1
230 IF C=254 OR C=126 THEN GOSUB
 440
240 IF RND(4)=1 THEN T(Y)=T(Y)+3
2:GOTO 260
250 IF RND(4)=1 THEN T(Y)=T(Y)-3
2
260 IF T(Y)>320 THEN T(Y)=320
270 IF T(Y)<0 THEN PRINT@LA(Y),Y
$;:T(Y)=0:U=U+1
280 IF PEEK(1024+B)=162 THEN DA=
DA+1:PRINT@448,"DAMAGE";DA;:PLAY
"T222;O5;V31;GF"
290 IF DA=5 THEN 560
300 XX$=XX$+CHR$(Q(RND(6)))+CHR$
(Q(RND(6)))+CHR$(Q(RND(6)))+CHR$
(Q(RND(6)))+CHR$(Q(RND(6)))
310 XX$=MID$(XX$,5,32):PRINT@320
,XX$;
320 J1=INT(JOYSTK(0)/31.5):J2=IN
T(JOYSTK(1)/31.5)
330 C=PEEK(65280)
340 IF J2=0 THEN PRINT@B,CHR$(12
8);:B=B-32:GOTO 360
350 IF J2=2 THEN PRINT@B,CHR$(12
8);:B=B+32
360 IF B<0 THEN B=6
370 IF B>320 THEN B=294
380 IF PEEK(1024+B)=162 THEN DA=
DA+1:PRINT@448,"DAMAGE";DA;:PLAY
"T222;O5;V31;GF"
390 IF DA=5 THEN 560
400 PRINT@B,N$;
410 IF C=254 OR C=126 THEN GOSUB
 440
420 NEXT Y,X
430 GOTO 140
440 E=0
450 E=E+1
460 IF E=4 THEN 490
470 IF PEEK(1024+B+(E*5))=162 TH
EN 490
480 GOTO 450
490 PRINT@B+1,STRING$(E*5,179);
500 PLAY"T222O5V31B"
510 FOR L=1+U TO G
520 IF T(L)=B+(E*5)-5 THEN T(L)=
0:HITS=HITS+1:PRINT@390,HITS;:PR
INT@421,HITS*10;:GOTO 540
530 NEXT L
540 PRINT@B+1,STRING$(E*5,128);
550 RETURN
560 PRINT@171,"game";:PRINT@176,
"over";
570 PRINT@265,"press";:PRINT@272
,"button";
580 FOR HY=1 TO 500:NEXT HY
590 C=PEEK(65280):IF C=254 OR C=
126 THEN RUN
600 GOTO 590
610 PRINT@265,"press";:PRINT@272
,"button";
620 C=PEEK(65280):IF C=254 OR C=
126 THEN 640
630 GOTO 620
640 PRINT@265,STRING$(14,128);
650 RETURN
```

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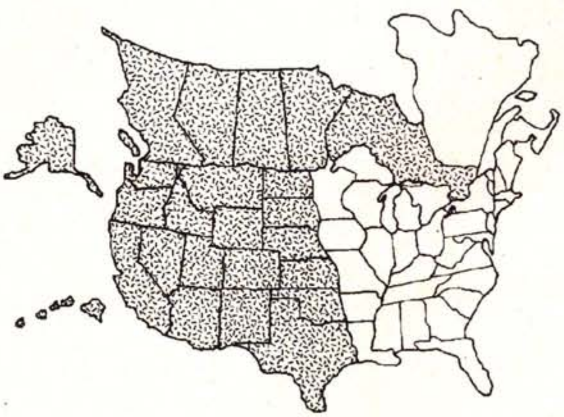

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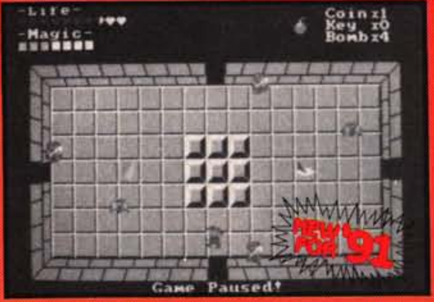
NEW FOR '91

SUNDOG SYSTEMS

The Quest for THELDA

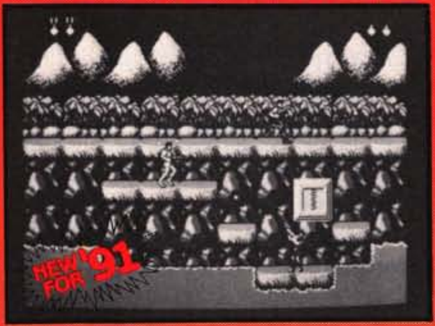


Better men than you have failed the quest, but the hand of the good princess Thelda is too much to resist! Stolen by the evil necromancer Divinax, she has been secreted far from prying eyes and it is now up to you to regain the pieces of the mystical Life Force and save the fair lady. The Quest for Thelda is an outstanding arcade program that combines action and adventure to bring you an incredible video game playing experience. Travel throughout over 500 different screens searching for magical objects and spells, lighting horrible creatures, and gathering the various parts of the Life Force guarded by ever-increasing terrors. You'll enjoy the highest quality 320x200 resolution 16 color graphics and digital sound effects that you've come to expect from Sundog Systems. The game play is fast and furious, and only you can rescue the princess and complete the **LEGEND OF THELDA!** Req. 128K CoCo 3, disk drive, and joystick (2-button joystick supported).

$34.95

Hint book now available for Thelda! Contains clues, maps, and even a BASIC program to modify your own characters! $4.95

★ THE ★ CONTRAS



In the year 2671, a mysterious object landed on Earth, heralding the alien invasion of the Red Falcon. Only two courageous soldiers have a hope of stemming this alien infestation. Armed with your military training and the latest weapon technology, you and a friend must fight back the horde. Sundog Systems presents our second 512K game, **The Contras.** You'll see why we decided to use 512K on this project! Amazing graphics with 320x225 resolution, 16 color full screen animation and horizontal smooth scrolling! Background digital sound effects and real-time music! One or two player action AT THE SAME TIME! You'll agree that this is one of the best arcade games yet for your 512K CoCo 3. Needless to say, playing hero won't be easy; playing The Contras will be tougher! Req. 512K CoCo 3, disk drive, and 2-button joystick.

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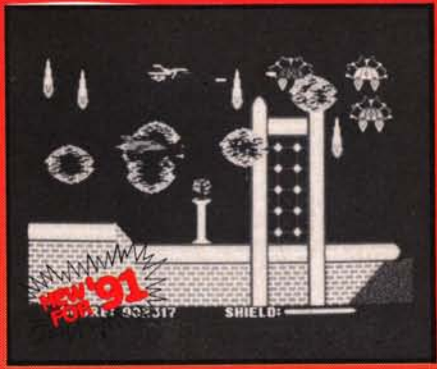
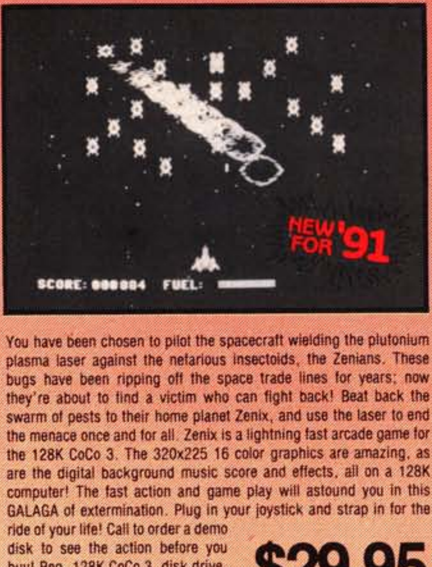
Crystal City



The superior technology of the evil Overlords has ensnared yet another innocent planet; however, this one contains the Crystal City, bastion of democracy and independence. Earth has had enough! Break through level upon level of their virtually invulnerable defenses, defeat the end guardians, and make your way ever closer to freeing the slaves of the Crystal City! This amazing arcade game is an achievement in its own right. Full 128K/512K utilization! Super fast horizontal hardware scrolling on the 128K computer! Wild digital sound effects and background music score! 30 minutes, or over 30 megabytes, of non-repeating 320x200 resolution, 16 color graphics! This game has it all; order a demo disk to see it first! Can you save the Crystal City from unbeatable foes? Req. 128K CoCo 3, disk drive, and joystick.

$34.95

zenix



You have been chosen to pilot the spacecraft wielding the plutonium plasma laser against the nefarious insectoids, the Zenians. These bugs have been ripping off the space trade lines for years; now they're about to find a victim who can fight back! Beat back the swarm of pests to their home planet Zenix, and use the laser to end the menace once and for all. Zenix is a lightning fast arcade game for the 128K CoCo 3. The 320x225 16 color graphics are amazing, as are the digital background music score and effects, all on a 128K computer! The fast action and game play will astound you in this GALAGA of extermination. Plug in your joystick and strap in for the ride of your life! Call to order a demo disk to see the action before you buy! Req. 128K CoCo 3, disk drive, and joystick.

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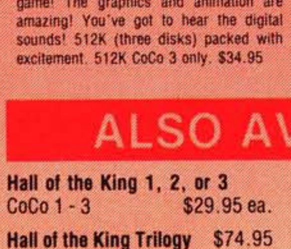
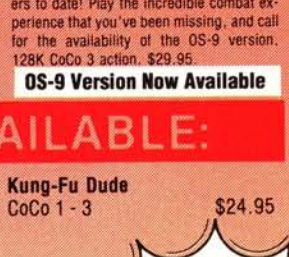


You've raved about this 512K arcade game! The graphics and animation are amazing! You've got to hear the digital sounds! 512K (three disks) packed with excitement. 512K CoCo 3 only. $34.95

KYUM-GAI TO BE NINJA



This martial arts arcade game remains a CoCo 3 phenomenon. One of our best sellers to date! Play the incredible combat experience that you've been missing, and call for the availability of the OS-9 version. 128K CoCo 3 action. $29.95

OS-9 Version Now Available

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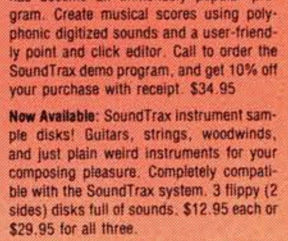

This 128K/512K sound sequencing system has become an immensely popular program. Create musical scores using polyphonic digitized sounds and a user-friendly point and click editor. Call to order the SoundTrax demo program, and get 10% off your purchase with receipt. $34.95

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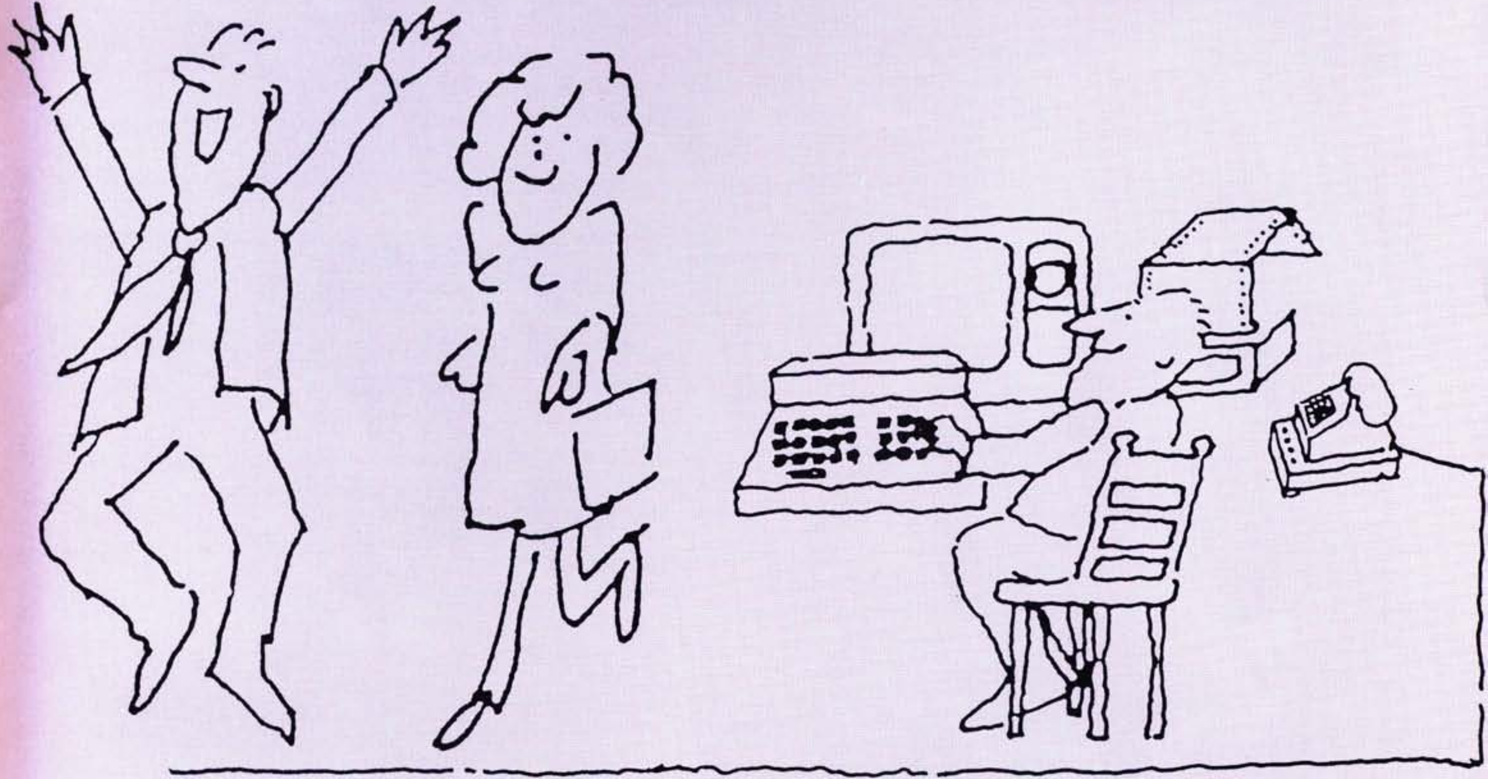

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